ARMY ORDNANCE

VOL. XIV, No. 83 MARCH-APRIL, 1934

Our Foreign Policy
Hon. William E. Borah

A Biologist Looks at War
Leon A. Fox

Disarmament and Defense
Sir Charles Petrie

Machine Gun Cannon
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Engines for Fighting Tanks
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Laugh, Hoodlums, Laugh!
An Editorial

A BIMONTHLY REVIEW OF AMERICAN MUNITIONS
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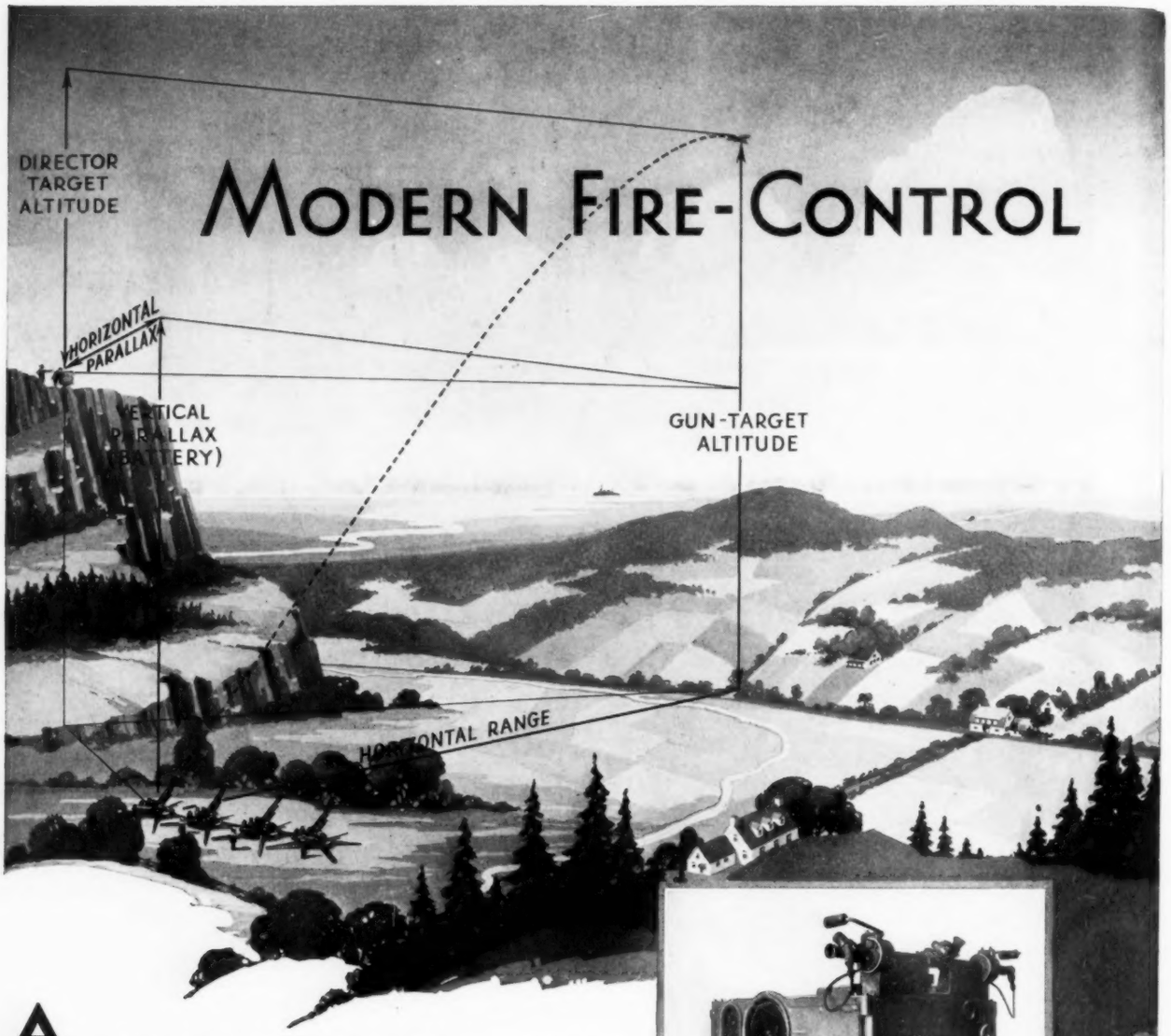
MODERN FIRE-CONTROL



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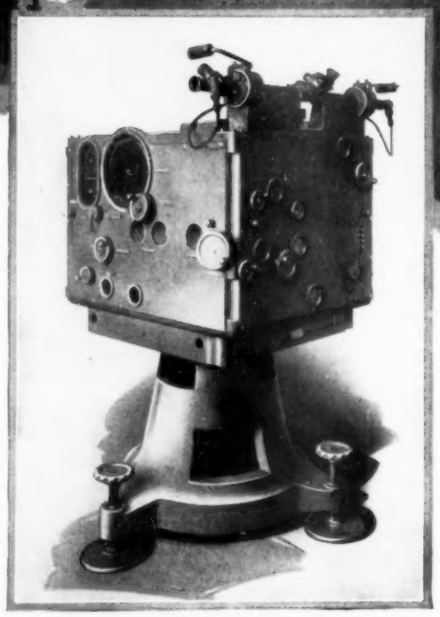

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ARMY ORDNANCE

The Journal of the Army Ordnance Association

Now in its Fourteenth Year of Publication

Pledged to Public Service in Effecting Industrial Preparedness for War as Our Strongest Guarantee of Peace

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"No nation, however desirous of peace, can hope to escape occasional collisions with other powers, and the soundest dictates of policy require that we should place ourselves in a condition to assert our rights if a resort to force should ever become necessary. . . . We shall more certainly preserve peace when it is well understood that we are prepared for war."—*President Andrew Jackson, Farewell Address, March 4, 1837.*

The Army Ordnance Association

THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guarantee of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

THE Army Ordnance Association believes that the solution of this problem, based on experience, lies in an active organization at all times coöperating with the Government. The principal objective of the Association is an active membership of American citizens, on whom the duty of design and production of munitions will fall in war, who will have an accurate and authentic knowledge of the complex requirements of ordnance. "Peace insurance" in this form is the foremost aim of the Army Ordnance Association.

The Association is purely patriotic; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit: its income is expended in furthering its aims. Its officers and directors serve without remuneration.

ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guarantees of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect cooperation with American scientists, inventors, engineers and manufacturers in civil life and the regular and reserve officers of the Ordnance Department;

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

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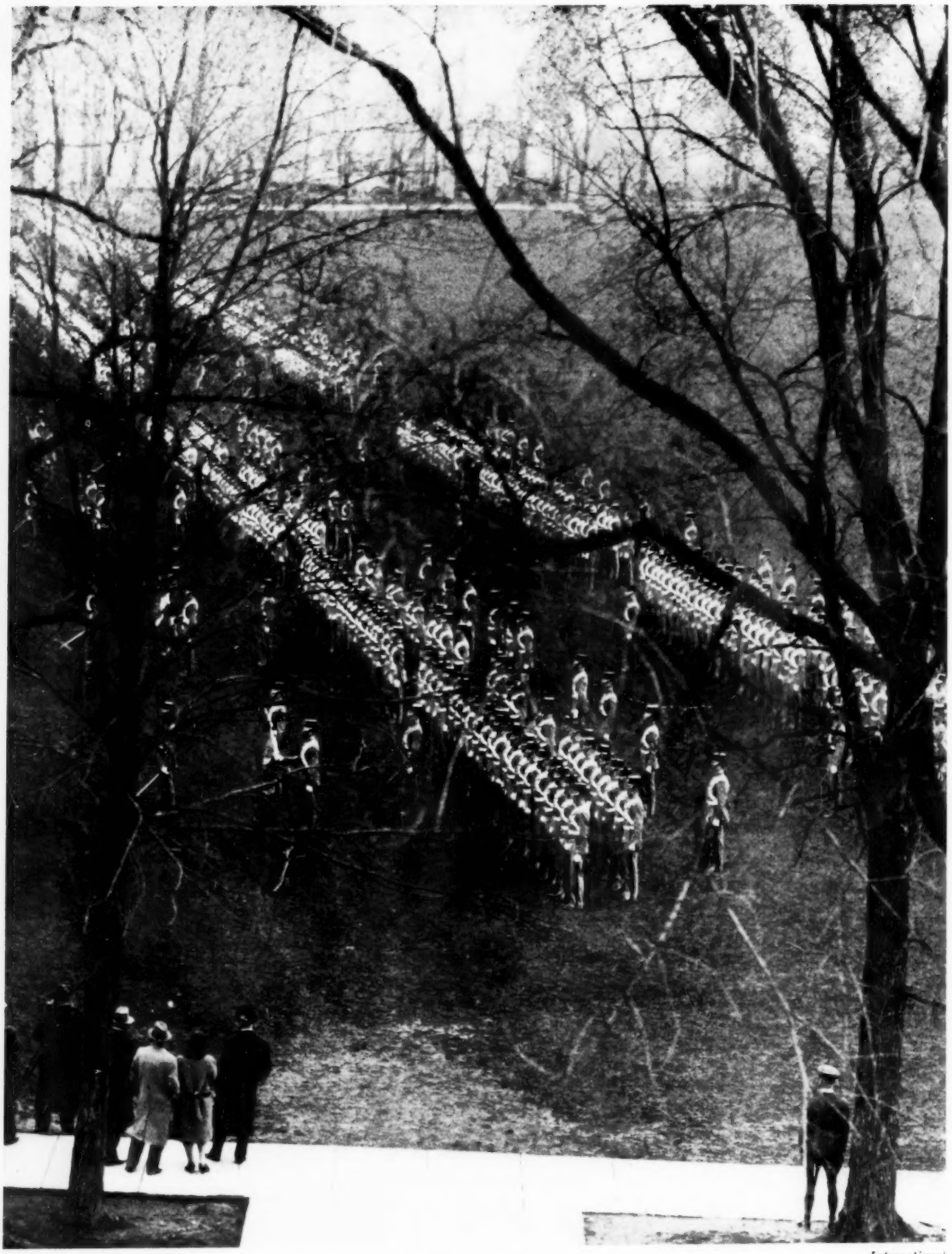


International

THE CORPS OF CADETS, U. S. MILITARY ACADEMY, WEST POINT, N. Y.

ARMY ORDNANCE

Vol. XIV MARCH-APRIL, 1934 No. 83

Our Foreign Policy

To Imperil Security Is to Invite Contempt

By Hon. William E. Borah*

THE strong tendency of all revolutions is to break entirely with the past. A new world is to be created. A new start must be made. What men have thought before is not important, perhaps harmful. The efforts they have put forth, the sacrifices they have made, are to be regarded as without value. Traditions and policies which have become interwoven with the moral and intellectual fiber of a people, the habits, customs, and mode of living, the institutions they have reared at great cost of money and blood, are sought to be rejected and forever put aside. Books and symbols are burned or in some way destroyed. This is the revolutionary idea. But, fortunately, it is never realized. Fortunately, the wealth—material, moral, intellectual—gathered through centuries of effort, cannot be destroyed. No revolutionary movement can wholly escape the living past. Tradition, after all, does not yield to revolutionary decrees. Experience will have a hearing. Reflection and the inexorable nexus of things bring men back to take up the broken threads, mend them, if possible, preserve that which is best, separate things which are fugitive from things which are permanent, and then go forward with that patient building which is the true and dependable method of permanent advancement.

Washington, in his immortal Farewell Address, said: "The great rule of conduct for us in regard to foreign nations is, in extending our commercial relations, to have with them as little political connection as possible. . . . Europe has a set of primary interests which to us have none, or a very remote, relation. Hence she must be engaged in frequent controversies, the causes of which are essentially foreign to our concerns. . . . Why quit our own to stand upon foreign ground? Why, by interweaving our destiny with that of any part of Europe, entagle our peace and prosperity in the toils of European ambition, rivalship, interests, humor or caprice?" Thomas Jefferson stated the same principle with greater brevity, declaring: "Peace, commerce, and honest friendship with all nations—entangling alliances with none."

This policy thus announced remained the unchallenged and revered policy of this Nation for one hundred and twenty-odd years. Whatever differences of view may have arisen in most recent years, none were found, and none will be found, I venture to believe, to question the wisdom of this policy at the time it was announced or for more than a century thereafter. Without it, the Republic could not in all probability have withstood the ordeal of those formative years. It was an indispensable part of the scheme of free government. Together with the Declaration of Independence, the treaty of peace, and the Constitution of the United States this policy made up the title deeds to our liberty and the guarantees of our independence.

There were giants in the land in those days, men of deep insight into government, of profound convictions, for which convictions they were always willing to contend and for which they did contend. But in all their contentions, upon this first great announcement as to our foreign policy there was no division. And down through the fierce years of political warfare in which men fought with the relentless ardor of great souls over almost every conceivable question of statecraft or politics, upon this policy they were united. Behind it and for more than a century was the combined support and loyalty of this masterly group of men, the only body of men in all history who successfully organized, set up, and maintained a real representative republic.

It was under this policy that we grew in strength and influence, settled our domestic problems, brought prosperity and happiness to our own people, and won and held the respect of all nations. Under this policy we announced the doctrine of neutrality and maintained it. We announced the Monroe Doctrine and saw to it that it was respected. In the midst of civil war we sternly rebuked those who would interfere in our domestic affairs, and our position was tremendously strengthened by the policy of non-interference, which we had always unwaveringly maintained. The influence of this Republic was felt throughout the world, not because of armies or navies but rather through the force of example; we lived up to our creed—peace, commerce, and friendship with all nations. We were not hated, we were not reviled because we did not do more, and, though alone, we were not afraid.

THE World War brought about for the first time a wide difference of opinion touching the foreign policy of the United States. Since that time it has been earnestly and ably contended that our foreign policy, so long a part of our national life, was no longer applicable to conditions brought about by that great conflict, and that it should be abandoned once and for all. With this program was to go that part of international law relating to neutrality. We were to assume a position in world affairs, the very reverse of that which we had held from the beginning of the Government. We were not only to accept full part and full responsibility in the adjustment of all questions of international import—and they were practically all of that nature—which should arise in Europe or in the Orient, but even in the remotest regions of the earth. We were never to assume the "immoral" position of neutrals. Nationalism and devotion to one's country were to be reduced to a minimum. Internationalism was to be the supreme,

*United States Senator from Idaho; formerly Chairman of the Committee on Foreign Relations, U. S. Senate. This article was originally addressed to the Council of Foreign Relations, New York, January 8, 1934, and is published in this Journal with the courteous permission of the author.

dominating force among the peoples of the world. Like other revolutions, it sought to break with all the past, its traditions, its policies, and the views and teachings of its mighty leaders.

In this revolutionary movement were two distinct groups of individuals—working to the same end, but in quite different ways. There were those who sincerely believed that the new course was the high and honorable and most beneficial course to pursue. They entertained the hope, if not the belief, that the Great War had wrought deep and lasting changes in the minds and hearts of the people of the world and that they were now ready to accept a wholly new theory of nationalism. It seemed to be their theory that war had brought all peoples into a more kindly, brotherly relationship—that in this awful baptism of blood peoples had found a new life and were henceforth to be guided by a new spirit. That those views were, and perhaps still are, sincerely entertained by many people no one can doubt.

There was another group of individuals having a large part in this program, not admirable in many respects, willing to surrender our foreign policy, but not quite willing, in the face of what seemed an unsettled public opinion, to say so outright.

Hence, began that shambling, equivocal policy which found expression in a multitude of reservations and all kinds of explanations, none of which nor all of which would have preserved the foreign policy which, like Peter of old, they professed to love but would not own in the hour of crucifixion. Following the period of reservations and the consolations which seemed to flow therefrom there came into international affairs a strange figure known as the "unofficial observer," a kind of international spy, going about over the continents listening in on other peoples' business. I say "other peoples' business" because had it been our business, we should have been there in the person of a duly appointed and authorized agent of the Government, assuming full responsibility with all participants. This practice brought discredit to our Government, impeached before the world our sincerity, and had a tendency at least to degrade the revered policy of Washington to the level of the fugitive discretion or whims of an international interloper. Whatever happens in the future, let's be rid once and for all of this un-American and humiliating policy, if you may call that a policy, which policy has none. Wherever we go or wherever we disclose an interest, let's go as full participants and assume full responsibility. One may personally respect, though he differs with, those who insist that our long-established policy has become obsolete and give their reasons in support thereof, although one may be permitted, I trust, to recall Chancellor Thurlow's remark in reference to the reasons given by his friend, Scott. But this shuffling, uncertain, apologetic attitude toward our American policy and toward the other peoples of the earth and nations of the world can excite nothing less than derision, if not the contempt, of all true Americans and all sincere and candid men everywhere.

THE hopes entertained that the war was to give us a new world have in no sense been realized. One of the ablest of those who entertained this hope, noted for his breadth of mind and candor of thought, has recently declared: "During the 1920's I held the conviction firmly that the world was to experience a period of great international coöperation in every field. Looking at the world today, one may still hope but certainly must question the soundness of that vision of the 1920's." No less illuminating are the words of Mr. Ramsay MacDonald, spoken a short time ago. He declared that he was "looking upon a stage with something moving immediately behind the footlights—an ominous background full of shadows and uncertainties," and that "confidence between nations was more lacking than ever." There is something moving behind the footlights; it is the inevitable forces of national life which often elude detection until they have begun to write their decrees.

In respect to international matters, the world has not changed, the Orient has not changed, Europe has not changed. The nations were never so heavily armed in peace times as in the fifteenth year after the signing of the armistice. Nearly $5,000,000,000 are annually extorted from impoverished peoples in preparation for another war. National frontiers in many instances are in effect battlefronts. The issues between certain leading powers are as inexplicable and irreconcilable as they were before the conflict began. The old system of the balance of power again dominates the European Continent. Diplomatic moves bend to its delusive assurances. The Corridor, the city of Danzig, Upper Silesia, the problem of the minorities, Manchuria in the Orient, the vindictive judgments of the peace treaties, the inequality of nations, now the cornerstone of international law in Europe, all these problems, truculent, and inexorable, serve to keep Europe armed and vigilant, and to warn us again and again that the reign of internationalism has not yet arrived. They are European problems arising out of conditions centuries old. The outside world cannot reach them. To make an attempt to do so would ignite the powder mine.

The answer to nationalism, it is insisted, is the nearness of all peoples by reason of modern invention and improved methods of transportation. Europe is now at our door, it is claimed, and Asia just around the corner. We cannot, therefore, be indifferent to their problems. We must have a part in all that concerns them; nearness makes their affairs our affairs. This matter of nearness seems to play strange pranks sometimes. It has certainly run counter to the expectations of many in the last 20 years, although we might have been well advised, since it had been doing the same things among the crowded peoples of Europe for a thousand years. Nearness has not begotten there a common interest or a common purpose or even friendly relations. It has not mellowed the individuality of nations or fostered and strengthened the spirit of coöperation. It has not induced the belief that because of nearness there should be less of the national spirit. It has not put an end to war or rendered it less likely to occur.

On my father's farm, with no other dwelling nearer than 2 miles, and in some directions nearer than 20, the doors to our home were never locked. If there was a key on the place, I never saw it. In our great apartments of today, with a multitude of families within easy reach, we have locks which lock themselves, and it is my feeling that even if these families were Japanese, Chinese, Italian, French, or Russian instead of Americans we would still keep the self-locking locks on the doors. Familiarity does not necessarily breed respect and propinquity does not beget confidence. Europe is as far away today—likewise the Orient—in everything which makes for the community spirit, for social understanding, for political accord, as it was when the greatest of political philosophers, the most profound student of Europe this country has ever known, joined with the wisest of political leaders in warning the American people against entangling alliances of any kind.

It is one of the crowning glories of the world that we have

different peoples and different nations and different civilizations, different political concepts. Standardization may be all right for cattle and sheep and swine of all kinds, but it is not applicable to peoples or nations and it is not in accordance with the divine economy of things.

ANOTHER revolution has failed. It had to fail. It could not escape the living past. It did not weigh sufficiently the inertia of human nature; it underestimated the strength of those ancient prejudices and fears, as well as those ancient faiths and beliefs, the intellectual and moral paths over which men and women had trodden for centuries. The fight against nationalism has lost. It was bound to lose. It was a fight against the strongest and noblest passion outside of those which spring from man's relation to his God, that moves or controls the impulses of the human heart. Without it civilization would wane and utterly decay. Men would sink to the level of savages. Individuality in persons is the product of the most persistent and universal law of nature. It is woven of millions of subtle and tireless forces. No power can change this law or frustrate its operation. This is equally true with nations. Internationalism, if it means anything more than the friendly coöperation between separate, distinct, and wholly independent nations, rests upon a false foundation. And when undertaken, it will fail as in the name of progress and humanity it should fail.

Out yonder in the sad bean fields of Manchuria, empty formula met reality, internationalism encountered nationalism, and the pathetic results are recorded in the great disappointment of many wise men. In an old Greek tragedy you will find this line: "Alas! How dreadful to have wisdom where it profits not the wise."

Nationalism, pride, and love of country is a passion peculiar to no people, indispensable to the welfare of all. To undertake its destruction is madness. To foster it, cultivate it, direct its finer qualities along high and honorable and peaceful lines, as exemplified in the precepts and examples of Washington, Jefferson, Jackson, and Lincoln, with countless others whose names will readily come into your thoughts, is the highest mission, the noblest calling, in which men and women associated with public affairs can engage and to which a free people can devote their aims and consecrate their energies.

Its maintenance has cost blood. So has religion. It has entailed suffering beyond the power of words to paint. So have all the creeds and faiths of men. But it is worth all it has cost. Ask the Polish people, taking a single instance from the crowded pages of history. Frederick the Great, in his old age, writing to Voltaire, said: "Now that Poland has been settled with a little ink and pen, the 'Encyclopedie' cannot declaim against mercenary brigands." But Poland had not been settled by a little ink and a pen. Physically dismembered, her national spirit lived on. Homeless, as it were, it appeared upon every battlefield for liberty and fought for the oppressed in every land under the heavens. Without a country of its own, this Polish spirit of nationalism made the land of the downtrodden among all peoples its home. When the World War came, near 200 years had intervened since the crime was committed. But there was no stronger feeling of nationalism anywhere to be found than in this dismembered country. And like a ghost of retribution, it pursued those who had inflicted what was supposed to be a mortal wound to their utter undoing. Shall we hope to achieve for the world what the despoilers sought to do with Poland? Even though we employ oceans of ink and millions of pens, our effort will be just as futile as was theirs. War may spread its ruin, you may wreck the fundamental law and uproot the institutions of your country—these are but the fruits of man's efforts. But a higher power has planted in the human breast devotion to country, and all permanent progress must rest upon that basic fact.

WITH these intimations as to my views, here I might stop. But the subject assigned to me by your spokesman calls for a more specific word. Our Foreign Policy in a Nationalistic World was the topic assigned to me for this evening.

It is a nationalistic world, intensely so. There can be no doubt about that. Everywhere the national spirit is evoked, fostered, and religiously maintained. Whatever we may think as to some of its policies and tendencies we must admit that under its welding, cementing, driving power different peoples have been lifted into a region of exertion and consecration nothing less than amazing. In countries where there was debility, incompetency, and utter demoralization among the masses there is now strength and vigor and hope. Trampling under foot the false and feeble philosophy which would disparage the healing, uplifting power of patriotism they sacrifice, suffer, and endure, and find their highest compensation in the increasing vigor, prestige, and honor of their country. These conditions and these sentiments are not likely to undergo a change in the near future.

If a foreign policy should be offered to these nationalistic nations which would not fit into, serve, and augment their nationalism, it would be rejected. Such a policy was offered to Japan. It was rejected. Where would a foreign policy based upon internationalism find reception in Europe or in the Orient? Like the dove from the ark there would be no place for it to light. When the security committee of the League several years ago sought of Great Britain her views upon the terms of the Covenant the committee was plainly informed that Great Britain would determine for herself whether there was a breach in the Covenant and would determine for herself what, if any, action she would take in regard to it if a breach should occur. Who would expect Great Britain to do anything different? And who would long respect her if she did do anything different? The invasion of the Ruhr, Corfu, the seizure of Manchuria, these things indicate rather strongly that all schemes of international cooperation must fit into national realization. Judging the future by the past it will always be so. Europe has not changed in this respect, and I venture to say, in the interest of civilization, it is well that she has not changed. Europe, with her developing nationalism, may throw many dark shadows upon the future. But Europe, without the national spirit, would be hopeless beyond redemption. Nationalism does not necessarily of itself mean militarism or war, as shown by our own history. But anything is preferable to suffocation in the fetid atmosphere of national decay. National decay begins where nationalism ends.

I am far more concerned about our domestic problems than I am about our foreign affairs, although our foreign policy will greatly help or hinder the Nation in dealing with our domestic problems. It will be a long time, I venture to believe, before there will be any necessity or justification for the United States engaging in a foreign war. But the questions at home are imminent; they are upon us, not only those which have to do with the depression, but many which are even of

a graver and more permanent nature, problems which have their roots deep down in our whole social and political structure. I could not get my consent, and you would not expect a discussion of these at this time. It is sufficient for the purposes of the evening to merely indicate some of them. Our stupendous debt burden, public and private, some $220,000,000,000; our constantly increasing tax burden, city, county, State, and National; the chronic waste of public money; the utilities problem; conservation and proper use of our natural resources; the banking question; the money problem; the more equitable distribution of wealth. These and many more problems push for consideration. No scheme on earth can give us permanent contentment or permanent prosperity until they are solved. Indeed they were contributing causes of the depression.

THE guaranty of our national efficiency, prestige, and strength, notwithstanding the many problems with which we must deal, and certain tendencies which seem to threaten our institutions is to be found not alone in wise leaders but even more in a united and a wise people—united not only by constitutional forms and one flag but united in spirit and exaltation of purpose. After all, the source of power under our Government is the people. If at that source there is wanting poise and judgment, devotion and wisdom, this will inevitably be reflected in unstable policies and unwise laws; the people "must nobly save or meanly lose the last best hope of earth." Our foreign policy, therefore, should be one best calculated to unite our own people morally, spiritually, and economically, to inspire them with a sense of national fidelity and personal responsibility.

This country has within her boundary people from almost every land under the sun, still conscious under certain conditions of the "mystic chords of memory." Every civilization has made its contribution to the American civilization. How easily to transfer the racial antipathies and political views and controversies of the Old World into our very midst. Once abandon our policy of aloofness from European controversies and we bring these controversies into American neighborhoods and into our national life. We are constantly warned how persistently that transfer takes place. Only recently the bitterness, the intensity, of a European controversy nerved the arm and guided the hand which grasped the dagger of the assassin not only in our very midst but under the most sacred and solemn surroundings.

Eschewing policies which tend to keep alive former attachments and the poliitcal controversies of the Old World, we should exert to our utmost the healing, cementing power of patriotism and mold 120,000,000 people into an invincible, intellectual, economic, and political force for the enactment and administration of just and equal laws.

In the immediate years, believing that I was laying the foundation for the adjustment of all our problems, believing that I was engaged in not only saving government but in saving souls, not only preserving institutions but preserving human liberty, like Peter the Hermit, with his tongue of fire, I would preach united national aims and ideals, I would instill anew the great truth that democratic institutions are the only hope for the personal worth, the dignity, and individual liberty of the citizen. I would frame all laws and shape all policies with these great ends in view. In no other way can we hope for contentment and power at home or respect and influence abroad.

In conclusion, permit me to say that I believe in the foreign policy which offers peace to all nations, trade and commerce with all nations, honest friendship with all nations, political commitments, express or implied, with none—the policy which not only in fact respects the rights and sovereignties of other states and nations without distinction of great and small, and particularly upon this continent, but which would also refrain from words or acts that would seem to challenge those rights. Under the shelter and the inspiration of such a foreign policy I would foster and strengthen that brand of Americanism which believes in the worth, efficiency, and grandeur of constitutional democracy, in the vigilant preservation of the personal liberty and the individual privileges of the citizen, realizing that our institutions and the whole vast scheme of democratic government depend upon our ability to harmonize the rapacious economic forces of the modern world with the political freedom and economic rights of the individual. Thus, armed with a sense of justice toward other nations on the one hand and a sense of duty toward our own people on the other, this Nation will remain at peace with all nations who want peace, and if there be those who do not, and will not, have peace, we will under such circumstances need have no fear.

Mr. President, there is no creed or faith, no political principle or form of government, but must at some time or other undergo attacks, and this seems to be one of the periods of challenge and general assailment. We read of a movement lately initiated in one of the leading countries of Europe to delete the Ten Commandments, presumably that part which says: "Thou shalt not kill"; edit the Lord's prayer, since that perfect supplication encompasses all men regardless of race or creed; abolish Christianity, and conform the teachings of the Nazarene to the practices and principles of their political leader. This wicked and blasphemous exhibition of diseased minds seems only a little more impious and no less vain and impotent than the persistent attacks everywhere encountered upon popular government, the right and capacity of the people to direct and manage their own political affairs. Here and elsewhere, either by those who in their own land have destroyed the last vestige of personal liberty, sending to prison and to the torture chamber men and women because of race, religion, or political opinions and sacrificing all rights of the people to the gratification of personal power, or by those in our own land who consult appearances rather than realities and mistake surface indications for the deep currents which move below, is heard the solemn pronouncement that popular government has failed and that constitutional democracy is dead.

WE need not be dismayed but we cannot be unconcerned. The right to worship according to the dictates of one's conscience, the right to freedom from persecution on account of race, are parts of that political liberty, that freedom from oppression which is the lifeblood of democracy. These things, together with free speech, a free press, the right of assemblage, and those guarantees, the sum total of which make up the inestimable blessings of personal liberty, are the things for which democracy stands. They are the things for which we stand. And I venture to believe that we will not fail to preserve them. Looking backward and looking forward, proud of our past and confident of our future, we shall find our highest service not only to our own but to mankind and to the peace of the world in transmitting these principles unimpaired to succeeding generations. This is our supreme duty.

I believe that the foreign policy of Washington and Jefferson and Lincoln will best enable us to meet and discharge that duty. I am, therefore, at all times, in periods of turbulence and in periods of calm, and without apology and without compromise, committed to its support.

This, it will be said, is isolation. It is not isolation, it is freedom of action. It is independence of judgment. It is not isolation, it is free government; there can be no such thing as free government if the people thereof are not free to remain aloof or to take part in foreign wars. People who have bartered away or surrendered their right to remain neutral in war have surrendered their right to govern. In matters of trade and commerce we have never been isolationists and never will be. In matters of finance, unfortunately, we have not been isolationists, and probably never will be. When earthquake and famine, or whatever brings human suffering, visit any part of the human race, we have not been isolationists, and never will be. In all those matters and things in which a free and independent and enlightened people may have a part, looking toward amity, toward peace, and the lessening of human suffering, we have never been isolationists, and never will be. But in all matters political, in all commitments of any nature or kind, which encroach in the slightest upon the free and unembarrassed action of our people, or which circumscribe their discretion and judgment, we have been free, we have been isolationists. And this, I trust, we shall ever be. If there be any truth established by the experience of nations, it is this: That to accommodate your foreign policies to the demands or in the interest of other nations at the peril of your own security is to invite contempt, and it seldom fails to earn a more substantial punishment.

In recent years much has been said, especially from abroad, about the provincial American. Those who discuss this and kindred matters modestly pay tribute to their own worth by speaking of world vision and of a wider human sympathy. One need hardly linger to discuss the subject. Regardless of what may be said by those whose purposes are apparent, let us hold fast to those political principles and foreign policies which others call provincialism, but which we call Americanism. It has served us well. It fits in with our scheme of democracy. It has built a civilization whose capstone is personal liberty. It may have its faults, as what earthly scheme has not. But all the world will have to testify that in great emergencies, in sublime moments, when civilization hangs in the balance, it is wanting neither in sympathy nor courage, and whatever faults it may possess are buried in the depth of a great unselfish and heroic purpose. It has no taste nor aptitude for the hazardous enterprise of uncovering aggressors or chastising national renegades. Here in its God-ordained home between two oceans, watchful of its own interests and vigilant in the defense of its rights, it covets nothing of others save the peace and friendship of all. It does not, and it never has, shrunk from its duty to civilization. It will not disown any obligation which human liberty and human justice impose upon a free people. But it does propose, I venture to prophesy, to determine for itself when civilization is threatened, when there may be a breach of human rights and human liberty sufficient to warrant action, and it proposes also to determine for itself when to act and in what manner it shall discharge the obligations which time and circumstances impose.

THE U. S. BATTLE FLEET SILHOUETTED IN A PACIFIC SUNSET.

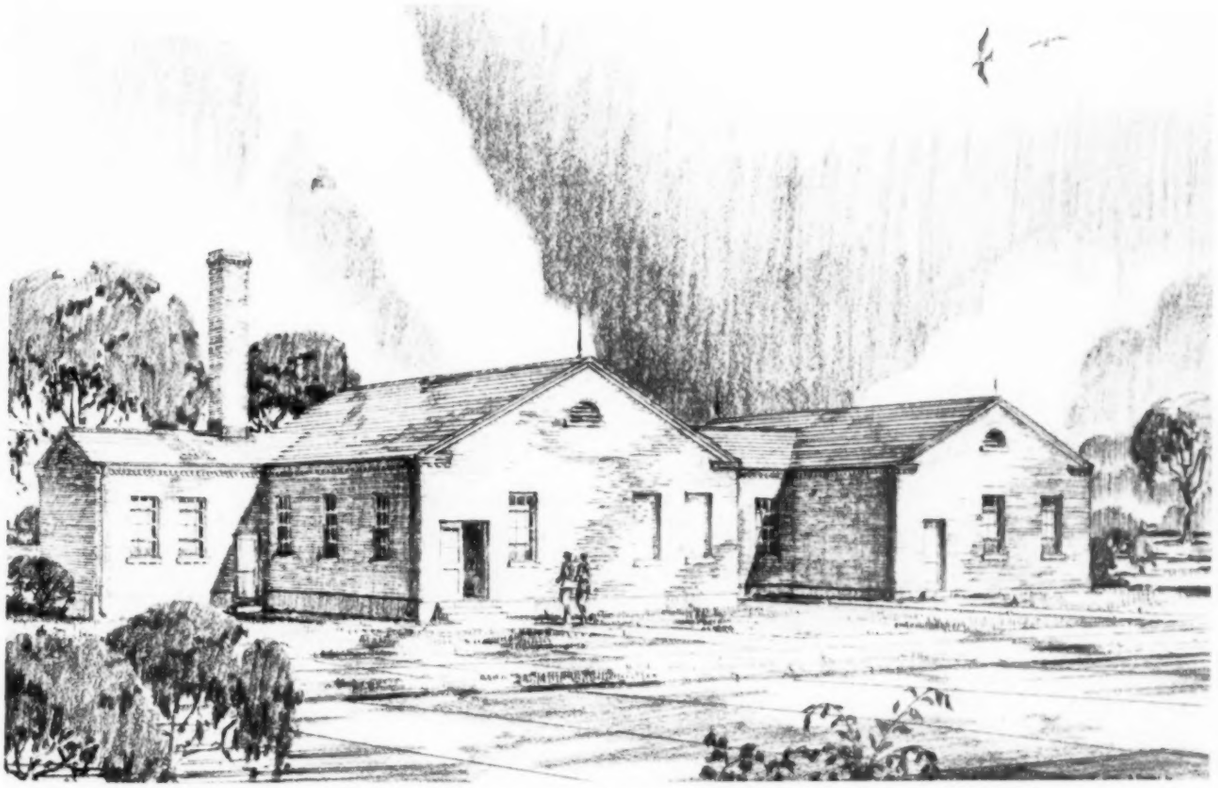
How The New Aberdeen Will Look

Entrance Gate and Sentry House.

The Ordnance School (with details of Entrance and Wings).

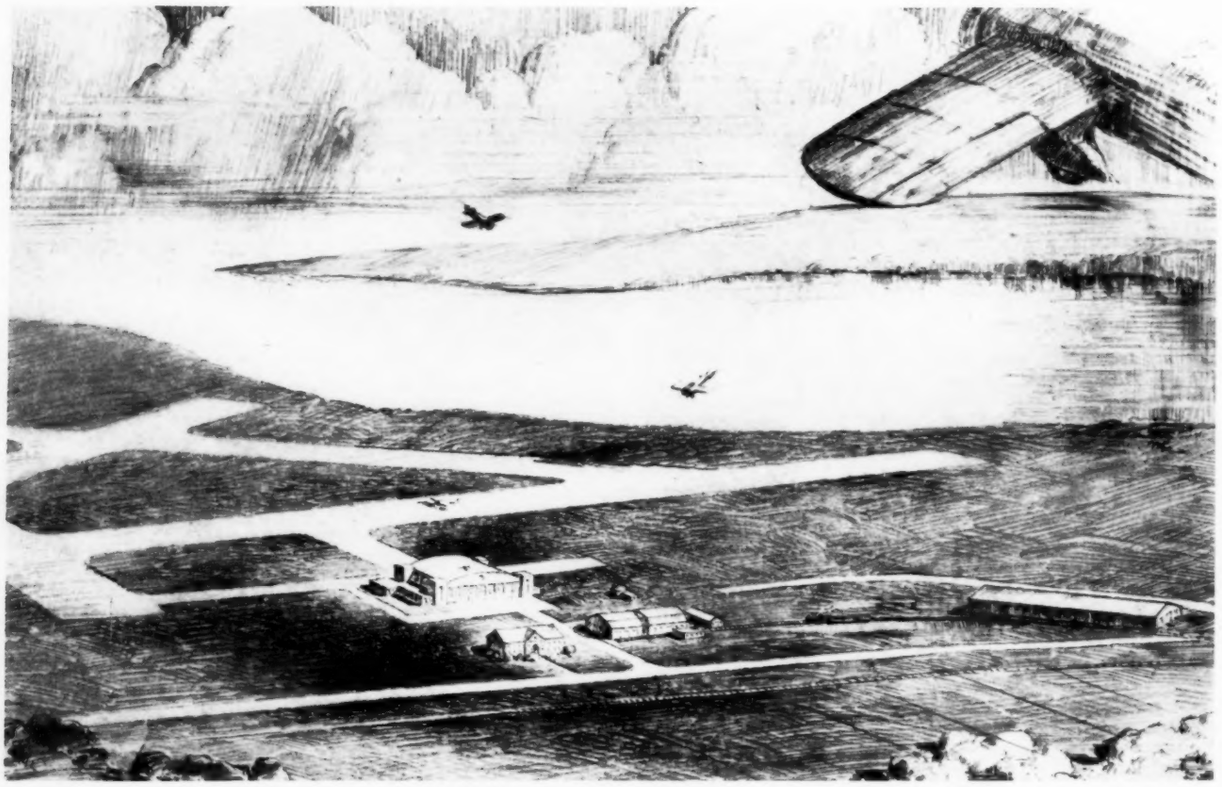
Architect's Drawings of the New Proving Ground

Fire Station and Guard House.

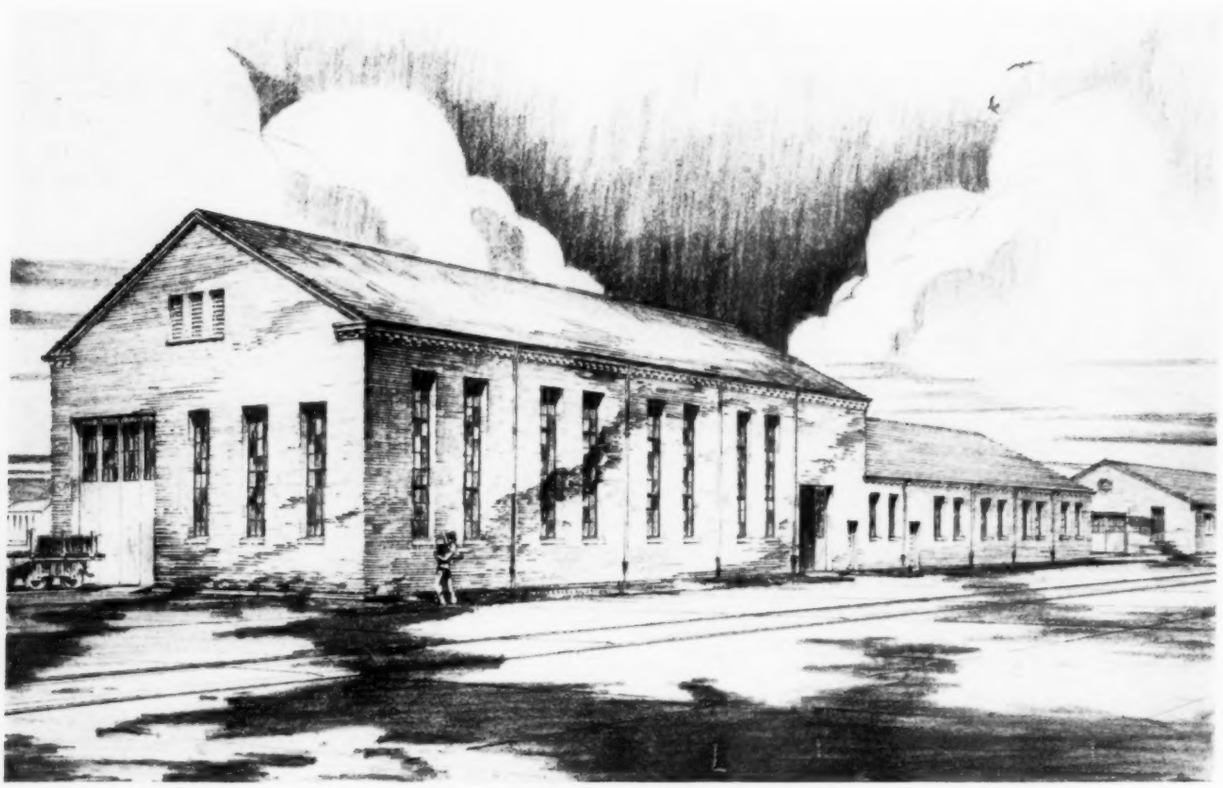


Constant Temperature Magazine (Water Battery).

Aberdeen Will Have The Latest of Technical Facilities



PHILLIPS FIELD—The NEW HANGAR, IMPROVED FACILITIES AND LANDING FIELD.



ORDNANCE WAREHOUSE (Main Front).

The Personnel at Aberdeen Will Have Real Barracks

Enlisted Men's Barracks.

Assembly Plant (Main Front).

A Biologist Looks at War

The Correlated Development of Man and His Weapons

By Leon A. Fox*

WE will review the evolution of weapons, a development that parallels the evolution of man. Since weapons are implements of combat, of war, I believe it well to make a few brief remarks on the cause and purpose of war. This may seem like a large order for such a brief discussion, but when we consider this subject from the biologic viewpoint the question is very simple.

Malthus is one of the great prophets whose work has been neglected. His studies on population are the foundation of one of our most certain biologic laws. Malthus deserves all the credit for the law even though he did have precursors in Buffon and our own Benjamin Franklin. It is impossible to state the Malthus hypothesis correctly without seeing that it is axiomatic. Biologic observations, especially those of the ecologist, the world over, support the law. Studies made on flies, rats or rabbits in Australia are always the same. Every experimental set-up has also confirmed the Malthusian hypothesis.

Only the economists reject Malthus, so he is truly the prophet without honor in his home, for his work was a study of human populations, and he was, above all, an economist. I can understand the rejection by the economists only by presuming that they do not read Malthus. They read about him. If they read Malthus they would know that only the first chapter of his great work is devoted to the expounding of his theory of population, and that all the rest of this great work is devoted to showing how man, as a thinking animal, may circumvent the dire consequences of unlimited increase in population. In the study he considers all of the factors that modern economists think they have discovered. He was familiar with the fact that any given acreage would support more agriculturists than hunting tribesmen. He was also familiar with the fact that improving agriculture would support greater populations, and had intelligence enough to appreciate the limits that nature set on this increase. I repeat, the economists do not read Malthus or they would not make so many ridiculous statements. Is it any wonder that most natural scientists smile when the economists refer to themselves as scientists, since they neglect the basic biologic laws in dealing with man, an animal? We will not have space to discuss Malthus' work in more detail, but if any reader has neglected to read this great work he should not deprive himself of this privilege longer; but read Malthus—do not read about him.

I have stressed this work because I consider all combat biologic, all war basically biologic. My thesis is that all combat, all war, is caused by the struggle for food and females. Possibly I should say food and sex, because sometimes it is the deadly females that engage in combat.

It is customary to picture the subhuman forms as terrible organisms that fight for the sake of fighting, an animal world that destroys itself because of vicious instinct. Could anything be further from the truth? The terrible lion and tiger are only terrible when hungry. With a full belly they become as sleepy and harmless as any well-fed cat unless disturbed by man or beast. I should add, of course, that they fight for a mate, so I say all combat is biologic. The cause of combat in the entire zoölogic world is the struggle for food and females. You can add the botanical world and I will still defend this thesis.

IF we start with the minute, unicellular, sexless organisms we find that the Malthus factor is the only thing in the struggle. The population will depend on the food supply. When we proceed up the biologic scale and reach the level where sex appears, the struggle for a mate immediately becomes manifest and is second only to the basic fight for food. I cannot take the time to slowly climb the zoölogic tree with you. We must hurry up to the uppermost branches where our fellows are fighting. But some time at your leisure make a slow mental ascent of this same tree that we are rushing up, and notice the detail of the struggle for existence and the cause of the combats you will see all about you.

We are now almost at the top of the tree, up with the anthropoid apes. They have numerous conflicts. They rend and tear each other with tusks and claws. I do not need to tell you what they are fighting for. Notice they have no weapons, no tools.

We are going higher. We come to the pre-man, quite human in form, but not men. They have no tools or weapons. The struggle for existence is just as intense. They fight but they can only bite and claw and choke an adversary. The combat is often decided by the opening of a carotid artery.

The human level is reached only when we find tools, and the first tools were weapons—tools for hunting and combat. The first ape to swing a club over his shoulder was a man, the primitive father of *homo sapiens*. We are at the human level, a low level it is true, and still we have found nothing to fight over but food and females. From here we will trace the evolution of weapons, but just a word more about the cause of these human combats, the cause of war. From the ape level up food becomes more and more important, females less a factor, until finally the educated man of today seldom fights over sex.

Do you question the importance of food in human war? The Punic wars were not fought for the glory of Hannibal, or Scipio Africanus, but to decide whether the Phoenecian Colony of Carthage should continue to eat or not. Rome decided that the food and wealth that went to Carthage was needed at Rome. Is it any wonder that we hear in the Roman senate, "Carthage must be destroyed"? Carthage was destroyed. Do you think the Teutonic hordes who pressed on and destroyed Rome were looking for polo fields? No, the migrations were caused by the search for new pasturage, for food. The same can be said for Genghis Kahn. He ruthlessly slaughtered whole tribes of agriculturists to let the land revert to pasturage. This Mongol leader knew of no other way to feed his warriors.

Do not think that modern wars are different. Is there anyone so dense today that he considers any other cause for the

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World War except commercial conflicts? Forget the war propaganda and consider the basic commercial conflicts. They were numerous and involved. They are the real causes of the war. Remember it is the load that breaks the camel's back and not the added straw. The same may be said about the spark that appears to cause a war. Commercial wars are wars for food. Consider the significance of Germany's plea for a place in the sun. The Germans did not refer to heliotherapy. They wanted trade, food. The question involved was food—food for England, food for France, Germany and many others.

I have stressed these fundamental biologic factors because I do not believe some pacifists consider them when they cry out to nations that it is always possible to sit down at the peace table and settle their differences. Sometimes the differences are serious and involve such important questions as: Whose sons and daughters are going to eat? The present conflict between China and Japan is fundamentally of such a nature, although it happens in this case that not much consideration is given to the daughters. This neglect of females usually occurs only when the Malthus factor has long been at work.

So much for the cause of wars. We will go back to our earliest man and study the evolution and development of the weapons that he uses in his conflicts.

IN the early combats man could only bite and claw and choke his adversary. This was the day of brute strength. Cleverness had relatively little value. The first man to use a weapon was the man with the best mind of his day. The first weapon used must have been very simple and elementary —possibly a hard object held in the hand with which he brained his opponent. This weapon possibly did not create much comment. This was not an age of comment; however, the descendants of the type that could not learn to use this weapon are not numerous. Has this weapon been abandoned? Certainly not; it is an excellent weapon, and no good weapon has ever been discarded. Its use today is very limited due to discovery of other weapons of greater range and effectiveness.

Development of weapons has always been for the purpose of using intelligence to overcome mere physical force. The factor of range, killing an opponent before he can close with you, is a most important factor when the man of intelligence must meet superior physical force or number.

Probably the first weapon to provide range was a club, possibly a sharp stick, the forerunner of the iron-tipped spear. The club may have had a stone head attached. These weapons not only advanced the clever man over the mere strong man; they aided man in his fight with the man-eating animals of the time. However, if we can make deductions from the early cave records of the men of this period, advance was slow because the intelligence was of such low order that they were slow to understand and accept these new weapons. The race improved because the thinker, the successful warrior lived and won the females and left descendants, the slow and reactionary type did not live to reproduce. With every advance in weapons man is giving evidence of a desire to overcome brute strength by means of a weapon with range and effectiveness.

We can picture the introduction of the early propelled instruments, such as the arrow, causing a storm of opposition. Some youngster designed some form of propelling instrument for a sharp stick and possibly suffered the jeers of the snaggled tooth elders as he shot the sticks into inanimate targets, and only received the reward of complete recognition when he shot a sharp stick through the belly of an old pack leader to take over a band of cowed females. The progeny of this genius were of a higher order of mentality and possibly soon learned the value of organization, with the result that a tribe of arrow users developed. This seemed like the final advance, and who can doubt their ability to inflict their will on the men of the time?

The fact that the conquered men, possibly of superior physical development, considered the weapon a cruel and brutal implement God had not endowed man with did not cause it to fall into disuse. The only thing that caused this weapon to fall into disuse and finally be practically abandoned was the development of such protection as caused the implement to cease to be effective or because other instruments were designed of greater range and effectiveness. These factors are the only things that have ever caused a weapon used successfully to be abandoned. With the development of such weapons as arrows and spears combat ceased to be limited to individuals. It became tribal combat or war. The value of organization must have been utilized. The value of motility and maneuver naturally resulted in the early use of the horse, with the resulting shock action so valuable even to this day with cavalry. Our earliest equine records and pictures all show the horse as a charger.

It is probable that protection did not lag long after the development of weapons. Realizing the value of the tree that he hid behind, man soon developed a substitute in the shape of a wooden shield that he could carry with him for protection. Later he used a leather and finally a metal shield. Helmets probably followed a similar line of development. Later on there were accessory weapons needed to go with the war club, battle ax, spear and arrow, for tribes grew into city states and built strong defenses, cities with walls, and other fortifications. The military engineers of the day produced rams, catapults, and other engines of war.

The development of the defense was not limited to the city; the defensive equipment of the individual improved until finally we had the armored knight; yes, the armored horse. What a picture he presents. What a grand figure he made until gunpowder brought him down. How gunpowder did upset the military organization of the day. We will not cry over the fall of these metal-encased dandies for you are all familiar with the revolution in military organization that followed the introduction of explosives. It is interesting to read the comments of the time. Gunpowder was condemned and villified then just as airplanes, submarines, chemicals and tanks are condemned today.

We do not need to review the evolution and development of the rifle. That is history. Our museums have the old blunderbuss, the muzzle loader, and the other weapons that preceded our modern repeating rifle. We can also study the development of the primitive cannon into the wonderful artillery weapons of today, including the heavy cannon and mortars with the light field guns and Stokes mortar.

These weapons are all important and every detail of improvement represents a contribution of intelligence, in certain instances amounting to genius; but they all pale into a subordinate position when we come to the machine gun, the real weapon of the World War, especially for the defense. It is impossible to exaggerate the importance of the machine gun in the defense of terrain. The World War was the first conflict to see it used on a great scale, and it not only influenced the entire tactics of the War, but contributed greatly to the

introduction of other new weapons such as tanks and chemicals.

The machine gun is the greatest defensive weapon ever invented. It may surprise you to have me stress the machine gun. You possibly consider the airplane, the tank and the use of chemicals more important. I cannot agree with this view. The airplane was very important during the War. After the first few months it carried on all the observation missions that had formerly been assigned to cavalry. It also did some destructive bombing; but the brilliant and dramatic aërial duels that we had featured in the war press were without effect on the outcome of the War. Future wars will see the military plane rendering greater service for this means of transportation was only in its infancy during the War. The tank was another World War development. Men simply could not go up against the hail of missiles from a machine gun. The armored tank was designed for this purpose. Even the first crude models had some success and they developed rapidly during the War, but it can hardly be claimed that they passed the experimental stage.

We will not review in detail the development and use of chemicals, but please remember that chemicals were used to try and break the dead-lock caused by the trenches and machine guns. The first chemicals used, the lung irritants, like chlorine, were hardly introduced before they were antiquated by the rapidly improving gas masks. We then had a repetition of the old struggle between offense and defense, powerful and still more powerful chemical agents were used, but better and better masks were made, until finally, just when the victory seemed won by the defense, mustard gas was introduced. This agent circumvented all masks because it did not have to reach the lungs to produce injury; it burned any part of the body with which it came in contact. Mustard is the most effective chemical weapon that has been developed. While of value for the offense it is especially suited for the defense and most military men rate mustard gas as second only to machine guns in defending terrain.

YOU ask about the future of chemical developments. I do not know what the future will bring. I do know, and I have had some chemical training, that chemicals such as certain sensational scare-head newspaper writers describe do not exist. There are no chemical agents so powerful that one airplane can destroy New York City. I do not care if "Lord Know Nothing" or any other dreamer says so. Such agents do not exist, but of course scientific facts never stop these sensationalists who live in the hyperbole. Do you wish my opinion? No chemical agent the equal of mustard for military purposes is known to the scientific world today. Improvements may be made, but chemical principles do not change, and I believe you can discount rather freely the wild claims that are made about the future of chemical warfare. However, do not be so foolish as to go to the other extreme and overlook or ignore this valuable addition to the fighting man's equipment. I believe that chemical munitions will be used in every great war of the future.

The outcry against the use of chemicals seems to people of this day to be quite a serious factor, and some wonder if their use will be curtailed by this influence. The following factors should be considered before we make a decision:

a. Every advance, every discovery of a new weapon by a scientist has had to overcome two groups of opponents: 1. The fixed and established military group who are always sure the new weapon "Won't work," "Is not as good as older weapons," "Not practical," etc., and 2. The pacifist group that considers each new weapon more terrible than the former and cries out against it.

b. The hue and cry that attended the introduction of chemicals is not unusual on the introduction of a new weapon. The early use of gunpowder produced a reaction in every respect similar to the cry of the present day pacifist against gas.

c. No effective weapon once introduced has ever been abandoned until it was displaced by a more effective weapon or protection developed that rendered the instrument useless.

Biologic Agents.—Will the next advance in warfare see the use of biologics? Will the next agent used be the living organisms, bacterial warfare, the scourge of armies from the most ancient times—the communicable diseases?

The question of biologic warfare will be considered in more detail because here again we run into the most elaborate and fanciful statements. It can be stated, however, that most of the references to bacterial warfare have been by pseudo-scientists who are entirely lacking in training in bacteriology.

A review of military history will reveal the great influence that disease has played in past wars. Volumes have been written on the epidemic diseases that have attacked the military forces. We will not attempt to review this extensive literature, but the doctor, especially the epidemiologist, knows that the student of history who only reads of tactics and strategy, the victories and defeats of a campaign, without familiarity with the medical history of the war, is likely to give some commander credit for success or failure that all too often has been caused by some epidemic of communicable disease. This is not meant to depreciate military success, for the great general is often a great sanitarian, and even Alexander may owe a part of his success to his doctor-philosopher-teacher, Aristotle's advice to "Boil his water and bury his dung."

We must remember that we can march through the pages of military history all the way to the twentieth century before we come to a campaign where the missiles of the enemy produce more casualties than epidemic disease. In most of the ancient campaigns of any duration some one of the great military plagues did more to decimate the military forces than all the man-made munitions. I say one advisely, although often many infections raged and famine and scurvy accompanied the communicable diseases.

What was the nature of these ancient pests? Were they diseases of that age now no longer known? No—the military pests that existed then are still with us. The Big Six of all time (war times) are: 1, the enteric fevers, typhoid and the paratyphoids; 2, the dysenteries; 3, cholera; 4, typhus; 5, the plague, the Black Death, and 6, smallpox.

Do not consider for a moment that the above diseases had any monopoly on the right to destroy armies. It is probable that at times influenza and the epidemic pneumonias took such heavy toll that but little fuel was left to be consumed by the Big Six. Again, under conditions where malaria is endemic, this disease is second to none in the production of noneffectives in military ranks. In fact measles and epidemic meningitis may well be added to the list of military scourges.

This paper is not for the purpose of considering the epidemic conditions of the armies of the past. But it is

realized that many individuals will naturally consider that if these infectious agents were able to produce such frightful outbreaks of disease by the simple process of chance infection under natural conditions, then in the hands of man, as a military weapon, they may well prove even more destructive. They fail to consider the fact that the same measures that are now so efficacious against the chance infections occurring in nature may prove of equal value in combating the same agency of destruction when used by man.

We have presented biologic warfare. Now let us analyze the problem in detail. What agents can be used to produce death and disease?

THE biologic agents available for warfare are: 1. The communicable diseases; 2. Other infective processes (such as wound infections), and 3. Toxic products of bacteria.

The communicable diseases are well known. They are the so-called transmissible diseases that produce epidemics. They are caused by a living contagion and are spread from man to man or animal to man by various channels of transmission. All of the Big Six and the other diseases mentioned above belong to this group.

The second group, the other infective processes that are available, include such infective materials as the agents that infect wounds, gas gangrene, tetanus, anthrax and other wound contaminations that are infectious but not communicable.

The last group of dangerous agents are the toxic products of bacterial growth. We will mention but a single terror-inspiring example—Botulinus toxin. A portion of this toxin almost inconceivably small, when introduced into the body by any channel, is lethal. We will give details later.

No one will question the effectiveness of all of these agents in producing casualties when introduced into the bodies of unprotected and non-immunized individuals. The important question then is "How"? How are these agents to be introduced into the bodies of the enemy to produce casualties?

Any consideration of the deliberate use of pathogenic organisms as a means of warfare will have to consider the question of how to produce a destructive epidemic in the forces of an opponent and at the same time protect one's own forces from invasion by the virulent organisms in question. Certainly at the present time we know of no disease-producing micro-organisms that will respect uniform or insignia, and the use of bacteria in warfare for the destruction of opposing forces will have to be predicated upon the successful prior immunization or the complete isolation of the forces employing the disease-producing organisms through some system of quarantine.

We will consider the communicable diseases in epidemiological groups.

THE Intestinal Diseases.—Mankind is all too familiar with the terrible epidemics of typhoid, cholera, dysentery, and the diarrheal conditions that have destroyed military forces in the past. However, it is highly questionable if this group of diseases will ever in the future cause any such terrible catastrophies for the reason that the epidemiology of these infections is so thoroughly understood, that modern sanitary methods and immunization processes have rendered comparatively innocuous these hazards of earlier armies.

The deliberate use in warfare of these agents, however, we shall consider. While occasional small outbreaks of these diseases may be due to food infections, real epidemics of this group of diseases are only traceable to infected water and milk supplies, or to such a complete sanitary breakdown that general fecal contamination of food supplies occurs. The possibility of contaminating a milk supply presents practically insurmountable difficulties, although it is theoretically possible that spies might use such a means to discommode and harass civil populations. It, of course, has no practical application to the military forces themselves.

Contamination of water supplies of civilian communities by means of infection of large reservoirs and storage basins where the water is held awaiting consumption, is a possibility. Contamination, to be effective, would have to be subsequent to treatment by the modern water purification plant consisting of filtration and chlorination, or of course it would be valueless; but this is within the range of possibilities, and it is possible that future wars will reveal that spies will make an effort to contaminate municipal water supplies.

The use of the intestinal group of diseases against forces in the field would probably prove entirely ineffective because modern water purification methods and the close supervision of the water supply that is accepted as a necessary incident of military service will absolutely preclude the successful employment of this means of combat.

In considering the intestinal group it may be well to stress the fact that the reason modern armies, and for that matter all civilized communities, do not have serious epidemics of these diseases is not because the infective agents that cause these diseases are not present or available, but because modern sanitation protects the personnel.

Let us take a typical example, typhoid fever. The incidence of typhoid in our civil population has been greatly reduced during the present century. Let no one think, however, that this is due to any scarcity of the typhoid bacillus, and it must also be remembered that the civil population has not had any general immunization such as helps to protect the Army. Typhoid has not retreated to the outskirts of civilization; it is all about us. Every state, yes, every county in the union, is infected. Typhoid carriers in the United States possibly number 100,000 and are generally without supervision. The reason we only have about 5,000 deaths per year in the United States instead of about 100,000 deaths from typhoid fever is because the great mass of our people now use water that has been rendered safe by filtration and chlorination. They consume milk that has been pasteurized and other foods that have been protected.

The same statement may be made concerning the low incidence of the dysenteries in our country. The infection is present, but epidemics do not occur because our sanitary measures are effective. We need not fear infection from without with this group of diseases; we are already grossly contaminated.

The die-hards will say that cholera is not so easily handled and is not at present a problem in America. Granted. We do not have cholera in the States; but our Army and our people do live in the presence of cholera without having epidemics of the disease. The Philippine Islands, where our Army maintains an effective fighting force entirely free from this terrible scourge, has a carrier incidence of the vibrio that causes cholera that is always high.

The intestinal group of diseases will certainly not prove destructive against any civilized nation that cares to pay the price of the protection that modern sanitary methods provide.

THE Respiratory Diseases.—In leaving the intestinal group of diseases we proceed from the problem that represents the greatest triumph in preventive medicine to the group of diseases that baffles the best efforts of all health workers.

In the control of the intestinal diseases we have so much to be proud of. In preventing the respiratory diseases we have accomplished so little. This is stated with a full knowledge of the wonderful results that have been obtained with smallpox vaccination, and the immunization to diphtheria by the use of toxin products, as well as with a full realization of the fact that we are on the threshold of equally great accomplishments in controlling scarlet fever.

It should be noted that these great accomplishments are not sanitary triumphs such as glorify our work with the intestinal group of diseases, but immunization processes. Not being able to prevent the infection reaching mankind, we take advantage of the fact that familiarity with the organism, while not breeding contempt, does produce immunity. Therefore we use the only method that appears to offer any great protection against the respiratory diseases in nature, namely, immunization.

Before we surrender to the individuals who threaten such frightful havoc with this group, we may well ask how are they going to start an epidemic of influenza, pneumonia or the common cold. If they answer that they will introduce the germs that cause these diseases we can well laugh at them. The process is not so simple. The factors that make respiratory epidemics are not so elementary. They include not only the infection of the individual, but the question of the resistance of the infected animal. The organisms that cause these diseases are all about us. They are always with us. Epidemics mean more than simply infection; they mean the rapid transfer from individual to individual of these infective agents. They mean a lapse in the immunity of the invaded, and possibly something else.

I do not know of a bacteriologist or an epidemiologist who can tell you how to start a respiratory epidemic unless the stage is especially set. I know many who are certain that whenever you place a large group of individuals, man or beast, under poor hygienic conditions, with over-crowding, poor ventilation, and exposure to unfavorable climatic conditions, or other factors that decrease resistance, respiratory outbreaks will occur in spite of any precautions that can be taken, and that if large numbers of highly susceptible individuals (rural populations) are present the outbreak can be expected to assume epidemic proportions.

The two diseases in this group that are most frequently mentioned are influenza and epidemic meningitis (cerebrospinal fever) possibly because of their importance during the World War. All that has been stated above applies with especial force to influenza where, in addition to the fact that no one knows how to control this disease, we must add that we are not even positive about the actual organism that causes the condition. Epidemic meningitis, on the other hand, is a very definite, specific disease due to a very well known organism. We must admit at the outset that this is a very serious disease and that it often assumes epidemic proportions in military organizations. However, if we stop to consider the nature of the organism and the epidemiology we see how entirely unsuited epidemic meningitis is for use as a military weapon. The organism, the micrococcus of Weichselbaum, is so delicate that even on the most favorable culture media it rapidly dies when exposed for even a few hours to temperatures much below that of blood heat. This disease is spread by carriers, and the organism must be introduced almost directly from the nasal pharynx of the carrier to the respiratory mucous membrane of the individual invaded or it will be destroyed by the unfavorable temperature conditions while en route.

Those individuals who think this disease may be used for military purposes will answer that carriers in the form of prisoners, etc., would be introduced into the opposing forces. To those who know anything about epidemic meningitis this suggestion is ridiculous. Any military aggregation of any great size already has so many carriers present (anywhere from 2 to 30 per cent) that the introduction of a few more or less is of no moment. Epidemics of meningitis only occur when overcrowding is associated with conditions that lower the general resistance as exposure, unfavorable climatic conditions, and fatigue. Meningitis is, and probably always will be, a military problem; but the individual's friends and associates, not the enemy, are the great problem with this disease.

We will not take up in detail all of the various respiratory diseases. The tabulation would prove tiresome, for the story would always be not so much a question of the great danger of the introduction of the infective agent, but the creation of epidemic conditions, a soil in which the organism could produce an epidemic, overcrowding and lessened resistance.

The venereal diseases are direct contact diseases. They are of profound military importance and have proved decisive factors in certain past wars; notably influencing the European campaigns of the fifteenth and sixteenth centuries. The deliberate use, however, of this means of injury is fraught with difficulties when we plan a method of securing personnel to effect the necessary exposure. The soldier's danger from the venereal diseases will not come from the open, avowed war-time enemy who loves him least, but from the money-loving or uniform-worshipping ladies who profess to love him most. Therefore, while these diseases may at times exceed all other causes of military non-effectiveness, we can dismiss them without further discussion while we are considering bacterial warfare.

THE Insect-transmitted Diseases.—These diseases will probably most certainly influence wars of the future as they have in the past. An invasion of such a country as Mexico, at the present time, would constitute more of a sanitary than a military problem. With malaria, dengue, and possibly even yellow fever along the seaboards, and typhus endemic in the plateau district, our main problems would be sanitary. Bubonic plague might also be encountered here as well as in any other place. This disease—bubonic plague—is the disease entity that many consider best suited for military purposes. To begin with, it is a frightfully serious malady—a decimating disease that has most profoundly influenced warfare in the past.

The use of bubonic plague today against a field force when the forces are actually in contact, is unthinkable for the simple reason that the epidemic could not be controlled. Infected personnel captured would provide the spark to set off possible outbreaks of pneumonic plague in the ranks of the captors. Infected rats would also visit and spread the condition. An advance over terrain infected with plague-bearing rats would be dangerous. Therefore, except as a last desperate, despairing hope of a rapidly retreating army, the use of plague by forces in the field is not to be considered.

The use of plague to harass civil populations presents less difficulty than the use of the organisms against a field force. Those who think that plague will be used as an offensive weapon consider that civil communities may be infected by introducing plague-infected rats. Of course this is easier to state than to accomplish, but it may be possible for airplanes flying low to drop recently infected rats. At least this is the statement that the individuals make who consider the use of this weapon feasible. Even with so terrible a pandemic disease as plague, however, there is a great deal more to the question of epidemics than mere infection. For instance, to cite an example, one that Gill so forcibly states, "Not half a dozen cases of plague occurred amongst Europeans (including British troops) stationed in the Punjab during the year 1924, when about 500,000, or one-fortieth of the indigenous population suffered from the disease." [1] If these intelligent people were able to avoid the infection when residing in an environment that was literally infiltrated with the infection, it certainly should be possible to control bubonic plague in a population such as we have.

For that matter, the question of plague is not a condition that takes us to the outskirts of civilization. Our own Pacific Seaboard became infected in 1900, and following the San Francisco earthquake the infection extended and is now more or less endemic as a rodent disease involving not only rats but ground squirrels. Here again it is not a question of can we control the infection; we are controlling it, and have not had an outbreak of human plague of sufficient size to designate as an epidemic.

The other insect-transmitted disease that is most frequently assigned a place of importance as an agent suited for warfare is typhus. This disease is certainly terrible enough to satisfy even those individuals who are anxious to preach the gospel of frightfulness. The military and civil populations that have been destroyed by typhus bear witness to how effective this agent of destruction can be. However, again we have a condition that is easily controlled.

Epidemic typhus is thoroughly understood. The epidemiology is so simple that it can be embraced in the name of the transmitting insect, the body louse. The control of epidemic typhus is the simple question of the control of louse infestation. Of course quarantine will help to prevent the introduction of the infection, but quarantine is futile if the Army is allowed to become lousy. The lousy Army may become the victim of typhus, even in America, without the introduction of infection from extraneous sources. The weight of opinion in the best epidemiological minds is that, as Maxcy suggested, endemic typhus is probably carried over between epidemics in a rodent reservoir. Endemic cases occasionally occur when transmitted to man by an insect, and when the infection is passed from man to man by the body louse, with the resulting enhancement of virulence, epidemics may be expected to result.

THE Infective Processes.—Certain disease processes that affect the tissues are caused by living organisms and are therefore designated as infective, even though they are not considered communicable in the sense that they tend to be transmitted from man to man. These disease processes include such infections as tetanus, gas gangrene, anthrax, and the ordinary pyogenic (pus formers) invaders. The agents that produce these infections have all been mentioned as possible war weapons.

The agents that cause tetanus, gas gangrene and anthrax are not delicate organisms such as the relatively short-lived, easily destroyed pathogens that cause most of the communicable diseases. They are very resistant, spore-forming organisms, generally capable of a prolonged period of viability without loss of virulence, even when separated from the animal tissues.

These spore-forming invaders are a real problem. Tetanus and gas gangrene are pathogenic processes that have always been associated with gunshot wounds and are therefore of special interest to the military surgeon. They do not produce epidemic diseases, however, and they are not communicable. They have to have a portal of entry made for them, a wound, and while the use of these organisms to contaminate battlefields might cause an increase in the number of cases of tetanus and gas gangrene, they would not increase the number of casualties. They would only complicate the treatment of those already disabled.

We cannot dismiss anthrax so readily; however, it is worthy of note that although anthrax is almost a world-wide disease nevertheless anthrax infection of gunshot wounds is practically unknown. If gross contamination of battlefields with the organism of anthrax is effected it is granted that cases of infection of wounds will occur, and possibly some few cases of infection in individuals who have not been wounded; but when we consider that human epidemic anthrax is unknown during the bacteriologic era, I question if we need fear greater danger from this organism than contamination of wounds.

IT will be noted that up to this point we have not discussed the technical difficulties that a military force would have in contaminating a hostile force. The difficulties in the case of the communicable diseases are so obvious that they need not be mentioned. The epidemiologic factors make the communicable diseases unsuited for offensive military use. The causative organisms are all either short lived when separated from the living tissues or else readily destroyed by ordinary routine sanitary precautions.

We cannot make this statement concerning the highly resistant infections such as tetanus, gas gangrene and anthrax. These agents are admittedly the most dangerous; but it must be remembered that to be dangerous they must be alive, and that many technical difficulties present themselves when living agents are to be used that are not present when missiles and chemicals are used. Shells can be used to project missiles and chemicals on to an enemy many miles distant; but bacteria cannot be used in this way. No living organism will withstand the temperature generated by an exploding artillery shell. Airplanes may contaminate terrain, but their effect would be quite local and probably less dangerous and less certain than high explosives used in the same way.

It is not maintained that bacterial contamination is impossible. A retreating enemy may hurriedly contaminate the terrain that is to be evacuated. However, it is believed that the use of living organisms in offensive warfare presents technical difficulties that are not generally considered. The contamination that spies and other individuals could effect, using the only really effective agents we have mentioned—the highly resistant, spore-forming organisms that are so dangerous to wounds—would prove too local to be of any value whatsoever.

1. Gill, C. A., The Genesis of Epidemics, London: Bailliere, Tindall and Cox, 1928.

Toxic Products.—The forms of bacterial warfare include not only the possible distribution of living organisms in the force of an enemy, but the possible use of toxic products derived from bacteria. Certain of our bacterial toxins are the most deadly poisons known. The toxin of the bacillus botulinus is so powerful that instances have been recorded where toxins have been produced so toxic that .005-milligram would kill a 250-gram guinea pig. This material, botulinus toxin, is poison for man. It is possibly the most toxic agent known, and will produce the lethal effect in any way that the material is introduced into the animal. If consumed with food, injected into the tissues, or even dropped on to the mucous membrane or conjuctiva, it is equally deadly.

This must be the material referred to when we read such dramatic statements as the following: "An airplane can carry sufficient toxins to destroy an entire city." Such statements have an element of truth in them. In fact they are conservative. An airplane could carry enough of the botulinus toxin to destroy every living man in the world *if* administration of the toxin was as simple a process as production and transportation. There were over 100 billion bullets manufactured during the World War—enough to kill the entire world population 50 times; but a few of us are still alive. It is easy to calculate the lethal (fatal) dose of a toxic agent; but do not think it is so easy to figure on the casualty producing power of a military weapon. The hostile aviator will not be received with a welcome, nor can he expect to land at an air field near any large city and find the entire population lined up ready to accept the carefully measured lethal dose of botulinus toxin.

It is difficult to evaluate properly the possible effects of the bacterial toxins. Certainly such statements as an airplane destroying an entire city with toxins is ridiculous; but they may have a value comparable to chemical agents, with this great disadvantage, however, bacterial toxins are readily destroyed by heat; therefore, like bacteria, they are unsuited for use in shells.

Animal Diseases.—The use of living organisms to produce disease in live stock, such as horses and mules needed for transportation of Army equipment and supplies, has been mentioned as a possible form of bacterial warfare. It is believed that the difficulties here are quite similar to those mentioned for diseases attacking man, with this great advantage to the defense that the veterinary officer will have in controlling epidemics. The veterinary officer can destroy any animal or group that he considers a menace to the health of the animals in the Army. The medical officer cannot take such steps to control human epidemics.

If we expand the term bacterial warfare to embrace such phases of biologic warfare as will include the agricultural pests, then an additional factor to consider is the fact that spies and possibly hostile aviators might inoculate growing crops with such pests as the boll weevil, the corn borer, the Mediterranean fruit fly, and like destructive agents. These agents in most instances, however, take so long to invade sufficient terrain to be effective in destroying crops that their value in actually overcoming the resistance of a foe is questionable. They take several years to advance over a large area, and might prove an economic problem years after the war has been completed; therefore, they violate one of the fundamental ideas in warfare: they would interfere with the ability of the conquered nation to pay the victors for the beating.

I consider that it is highly questionable if biologic agents are suited for warfare. Certainly at the present time practically insurmountable technical difficulties prevent the use of biologic agents as effective weapons of warfare.

I DO not wish the reader to understand that because I have given so much consideration to biologic agents the possibility of further development of the inorganic or non-living weapons is at an end. On the contrary great developments will be made. The range and the accuracy of all the weapons, rifles, machine guns, and all forms of artillery will most certainly be increased. Airplanes will be constructed that are faster, that are larger, that can carry heavier bombs. More accurate bombing will come, and the Shasta fiasco will be only a bitter memory. Tanks will be constructed that perform satisfactorily when tested under battle conditions. No one can limit the extent of the development, for the improving mind of man will demand and will make better tools of all kinds—better tools for his peaceful pursuits and better tools, better weapons, for his fighting men if war must come.

I call this to your attention because I believe that the more enlightened and developed a nation is the more effective its military machinery. I wish also to call to your attention that it is not the development of powerful weapons that makes war terrible, it is not the weapon that is terrible, it is the man who is at war that is the important factor. Every advance in weapons is the product of an advance of intellect. The more intellectual a man the more humane. If we listen to the pacifists we will think that war is becoming more terrible because of improved weapons. You cannot make war less certain or less terrible by taking away man's weapons. Is it more humane to fight as the apes fight, as the entire sub-human animal world fights, with tusk and claw, than to fight with weapons? Would it be a human world if the strong back ruled instead of the gifted intellect? Compare the horrors and destruction of ancient conflicts with the wars of today and you will realize that war has become humane. This humaneness has only this connection with improved weapons. The highly intelligent nation with a modern fighting machine is less a brute force than primitive man.

I mention these factors because some the pronouncements that reach us from Geneva are so ridiculous. Some of the disarmament proposals that limit the caliber of artillery, the employment of chemicals and other scientific methods of warfare would, in effect, reduce the intelligent man to the level of his less intelligent brother. Do they regard war as a game or sport? Can we expect an order barring a successful general, one who has won a battle, from future wars as a professional? Can we expect America, the great industrial nation, to sacrifice her chemical and mechanical advantages if she is attacked by less competent hordes? Cannot these peace lovers give some thought to the basic causes of war? Possibly a biologist on the peace commission might help.

It is believed that it has been shown that the development of implements of warfare represents an evolution based on the gradual application of the improving mind of man. The one factor of importance in this development has been effectiveness. It has been a question of the good mind versus the strong back; of the thinker versus the lifter. It is believed that the future of warfare will be based on the same principles. It is therefore apparent that the question whether weapons will be used or not will depend on their practicability rather than on the sentimental reactions or inhibitions of pacifists.

Machine Gun Cannon

The Disadvantages of Increased Calibers

By Glenn P. Wilhelm*

IT seems needless to state that the evolution of automatic weapons in reality began before the introduction of gun powder. From earliest times there has been a continual attempt to augment fire power by mechanical means. It has been stated that one machine gun is the equivalent in fire power of from 50 to 200 rifles. This is true in so far as volume of fire is concerned, but the weakness of the machine gun as compared to the number of rifles it displaces is that a mechanical stoppage or a hit by one shell will put it out of action, while it is practically impossible to put 200 riflemen out of action.

Because a semiautomatic rifle mechanically does the work hitherto done by the soldier in operating the rifle bolt so as to load cartridges from the magazine into the chamber and to throw out the fired cartridge cases, the fire power of the Infantry soldier is doubled, while at the same time the period of training time is reduced by one-half.

When some 2,000 years ago Dionysius, the Alexandrian, designed his polybolos (repeater thrower) by which he fired a succession of arrows fed from a magazine or hopper, little did he realize that while fire power was being obtained it was at the sacrifice of simplicity and that he was introducing mechanical difficulties with his machines, and that these mechanical difficulties were to be the bugaboo of "repeater throwers" and their operators for untold generations.

It is to be hoped that Dionysius had troubles with the doubting Thomases of his day. Surely he was told that his machine was complicated to make, difficult to operate and impossible to transport. Men had to be carefully trained for its use, and every time it jammed, the individualists doubtless held out for the use of five men each with a bow to five men with one gadget which by its size, appearance and weight unduly attracted attention. Wonder at the new engine coupled with its morale effect won the day and made up for any slight defect which prevented any more material results.

Hand-powered Machine Guns.—A hand-operated machine gun is a gun operated by hand power applied to a suitable mechanism by which cartridges are loaded, fired, extracted and ejected, the cycle continuing as long as the mechanism is worked and there are cartridges to feed the gun.

During the Civil War, Dr. Gatling brought out a hand-powered machine gun which was used to a considerable extent in the latter years of the war. This, of course, is a hand-operated machine gun which was extensively used up to and including the Spanish-American and Boer Wars.

The Franco-Prussian War saw the introduction of the French Mitrailleuse, which, in common with the Gatling, used a large number of barrels, the chief difference being that the Gatling was more on the order of a revolver with revolving barrels, while the Mitrailleuse maintained the barrels in a fixed position. Recently some consideration has been given to returning to hand-operated machine guns or to a source of power not inherent in the gun mechanism, but until high-power cartridges are made without the possibility of hang-fires or ruptured and separated cartridge cases, hand-powered weapons cannot compete with the self-contained automatic weapons, as the latter stop when these malfunctions occur, while the former continue in operation with serious results to the gun if not to the operator.

Automatic Weapons.—An example of an automatic weapon is the modern automatic machine gun which performs automatically, either by blow back, by recoil or by expansion of powder gases, the entire cycle of operation of loading, firing, extracting and ejecting.

These weapons were made possible only when the modern brass cartridge case was perfected in order to effectively have fixed ammunition with good obturation. The pioneer of the modern machine gun was the Maxim, which was operated successfully as early as 1884. This weapon and its offspring, the Vickers, have probably killed and wounded more human beings than any other weapon that mankind has ever invented, as it was the mainstay of the Germans and the British in the World War. It was used to a limited extent in the Boer War.

All automatic weapons are based on three general principles or upon some modification of these three general principles. These principles are, 1st—blow-back, 2nd—recoil-operated, 3rd—gas-operated.

The blow-back is the simplest principle of operation of any automatic weapon, but it was not used successfully in weapons of military power until after machine guns were first made on the other two principles. The blow-back principle merely means that the breech block or bolt is held against the cartridge by a spring in such a way that the bolt is forced to the rear against the spring when the gun is fired. This principle works very well for self-loading sporting rifles of comparatively low power and for so-called automatic pistols of low power. To attempt to use this system for the Springfield rifle would require a bolt weighing more than 25 lbs. in order to prevent the breech from opening too quickly.

The only blow-back guns of military importance are the ones modified in such a way that they are called "retarded blowbacks." In this class come the Austrian Schwarzlose machine gun used in the World War, the Pedersen semiautomatic rifle perfected in recent years, and semiautomatic rifles or submachine guns based on the so-called Blish principle. The Schwarzlose and Pedersen use a toggle joint which delays the blow back, while the guns based on the so-called Blish principle use, in the case of the Thompson submachine gun, an inclined plane in the form of a wedge-shaped lock, and in the case of the Thompson caliber .30 semiautomatic rifle, a screw which is, of course, another form of an inclined surface. All these retarded blowbacks, in order to obtain uniformity of extraction and to assist in the blow-back action, used lubricated cartridge cases in one form or another, the Schwarzlose squirting oil into the chamber of the gun, the Thompson guns, on the Blish principle, using oiled pads over which the cartridges pass, and the Pedersen using waxed cartridge cases. (Note: The Blish principle is based on the claim that inclined surfaces will slide under light pressure but will

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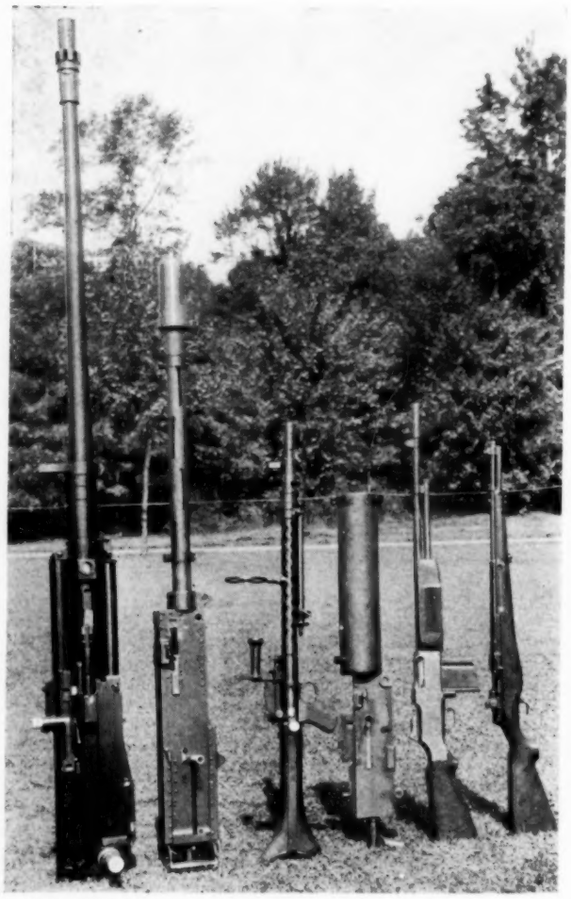
not slide under extremely heavy pressure.)

The recoil-operated principle is based on the fact that when a gun constructed on this principle is fired, the barrel, barrel extension (variously named) and the bolt remain locked when the cartridge is fired, although they are allowed to recoil to the rear a slight distance through the receiver until the bullet has left the barrel. By various mechanical solutions in different designs the bolt becomes unlocked and travels far enough to the rear to accomplish the necessary feeding operations of the cartridge, the barrel remaining recoiled until the bolt on its forward movement again becomes locked to it when the entire mechanism returns to its original position. In this class we have the Maxim, Vickers and Browning machine guns of the World War.

Although the recoil principle is most widely known, the gas-operated guns are not far behind in popularity. This principle is based on the utilization of a portion of the powder gases so as to have them act on a piston, driving it to the rear with sufficient force to unlock and open the breech. The gas may be taken from the barrel in a hole drilled in the barrel at any point between the chamber and the muzzle, although in some weapons the gas is taken at the muzzle of the barrel itself.



Increase in Size of Automatic Weapons as the Caliber Increases.

Reading from right to left: Caliber .276 (7-mm.) semiautomatic shoulder rifle weighing 9 lbs.; Caliber .30 (7.62-mm.) automatic rifle weighing 16 lbs.; Caliber .30 (7.62-mm.) water-cooled machine gun weighing 30 lbs. without water; Caliber 7.92-mm. (.313 inches) light machine gun weighing 20 lbs.; Caliber .50 (12.7-mm.) aircraft machine gun weighing 55 lbs.; Caliber 20-mm. (.79 inches) air-cooled automatic cannon weighing 143 lbs.

The most famous of the gas-operated automatic weapons are the original Colt, the World War Hotchkiss, and the present Hotchkiss types of weapons, the World War Marlin machine gun, which grew out of the old Colt, the Browning automatic rifle and, latest of all, the Garand semiautomatic rifle.

THERE are any number of different mechanical solutions of the three standard principles of operation; for instance, the Maxim, the Vickers and most recoil-operated aircraft machine guns have an attachment around the muzzle against which the powder gases following the bullet impinge and, in rebounding, exert pressure against a disk attached to the muzzle of the barrel to assist in recoiling the barrel. Thus these weapons are a combination of recoil- and gas-operation, although the forces exerted by the gas play a minor part and are not essential for operation.

The first important variation from a standard method of operation is considered to be the method used in the Bang semiautomatic rifle (1909). Although it was gas-operated, the gas emerging from the muzzle blew forward a disk on a lever, which in turn pushed back an operating rod similar to the gas piston, thus opening the bolt.

During the World War a crude mechanism was presented to the Ordnance Department which in reality was a *"blow forward"* instead of a *"blow back"*; that is, the barrel went forward due to the force of the explosion and friction of the bullet instead of going backward or instead of the bolt going backward. It lacked safety features, however, in that it was not properly locked at the breech.

About ten years ago Garand made a semiautomatic rifle on the blow-back principle, except that only the primer blew back until the bolt was unlocked by the rear movement of the firing pin. The remaining movement of the bolt was on a straight blow-back principle.

During the semiautomatic rifle tests, in the period 1927-30, Mr. J. C. White presented a gas-operated caliber .276 which allowed for the expansion of the gas in the gas cylinder by having a movable sleeve valve that cut off the gas port almost immediately in order to ease the action. Also, recently Mr. R. F. Hudson has a gun which, according to his circular, is gas-operated with the gas first compressing a spring to the front and then having the spring in turn open the breech mechanism. This is claimed to reduce the recoil of firing.

The most original and newest method of operating an automatic weapon is that used by Mr. David M. Williams in the new caliber .22 machine gun made by modifying a Browning caliber .30 machine gun. Mr. Williams has a movable chamber in which the cartridge is held, the bullet resting in the barrel. When the cartridge is fired the recoil of the bullet moves the movable chamber slightly to the rear, whereupon the expansion of powder gas against the face of the chamber gives it a great deal of power, so that the caliber .22 cartridge will operate a full sized caliber .30 machine gun. This principle is a unique combination of gas and blow-back. It is the only known way to gain great operating power from small cartridges.

AUTOMATIC weapons are gas engines of considerable power and extremely light weight considering the power. With the caliber .30 cartridge the power generated by the weapon as an engine has been variously estimated as from

25 to 75 horsepower. The greatest difficulty in firing automatic weapons is the problem of dissipating the excess heat, although only about one-fifth of the total heat is required to be dissipated.

There are only four methods by which automatic weapons can be kept reasonably cool. In the order of superiority for sustained fire with the caliber .30 cartridge these methods are—(1) Watercooled; (2) Air cooling with quickly changeable barrels. (In this class light quickly changeable barrels are probably preferable to heavy quickly changeable barrels, depending upon whether their tactical use is in short bursts of fire with short intervals of cooling or long bursts of fire with long intervals of cooling. In the latter case the heavy barrel has the advantage while firing, as it can absorb more heat, but has the disadvantage that it requires a longer period of time between firings to dissipate the larger amount of heat absorbed.) (3) Air cooling with heavy, fixed barrels, and (4) Air cooling with light, fixed barrels. Arranged in the order of total weight of guns and accessories, these categories would be in the reverse order of superiority.

INCREASE IN SIZE OF FIXED AMMUNITION FOR AUTOMATIC WEAPONS AS THE CALIBER INCREASES.

Reading from left to right: Caliber .276; Caliber .30; Caliber .50; Caliber 20-mm.; Caliber 37-mm.

THERE are four proven methods of providing a means of holding the cartridges and feeding them in the proper time and sequence in an automatic mechanism. These are, in the order of their superiority for sustained fire combined with weight, simplicity and sureness of functioning: (1) Flexible ammunition belts—fabric or metallic links—(used by Maxim, Vickers and Browning); (2) Rigid feed strips; (3) Semipermanent or permanent magazines (part of the weapon and do not require changing but must be loaded each time), and (4) Magazines which are quickly changeable. (May be loaded in advance or at the time of using.)

The relative advantages and disadvantages of each type are as follows:

a. Providing the magazines are loaded in advance, the magazine feed has the advantage of allowing ammunition to be fed to the gun without the necessity of pauses required for stripping the cartridge clip as is the case with the rifle. They have the disadvantage that the magazines weigh considerably, are easily damaged and, as compared to heavy machine gun types of feed, require pauses to replace magazines.

b. Feed strips have all the advantages of magazines and in addition are not subject to the disadvantages of pauses to remove the strip, as in an emergency one strip can be made to follow another without a pause. The feed strip will hold more ammunition than the usual type of magazine but it is subject otherwise to the same disadvantages as the magazine with regard to injury; it does not protect the ammunition as well as does the magazine and adds less to the total weight than is required by the use of magazines.

c. The use of semipermanent magazines or permanent magazines, while doing away with the additional weight, is usually at the sacrifice of sureness in functioning and simplicity.

d. The belt feed is one of the simplest and most efficient of all methods of feed, allowing sustained fire without much increase in weight. It has the sole disadvantage that it is somewhat inconvenient to transport when the gun is kept loaded with the belt in place, and must be loaded in advance.

Now let us discuss the classification of automatic weapons as to weight and use.

Rifle Caliber Automatic Weapons.—The heat problem is the chief reason why it is necessary to divide automatic weapons of the same caliber into various classes. These classes depend almost entirely upon the means provided for sustaining fire. When long sustained fire is necessary the weapon must be heavy and water must be provided for its cooling. This, in turn, requires additional accessories and a heavy tripod. If the weapon is to be fired a few rounds at a time only, it can be fired from the shoulder. The necessity for cooling then brings about the following classification of automatic weapons of the same caliber in the order of the least weight: (1) Semiautomatic rifles; (2) Light machine guns or so-called machine rifles, and (3) Heavy machine guns.

The weight of a weapon and its ability to sustain volume of fire determine its use. A semiautomatic shoulder rifle obviously cannot perform the mission of a heavy water-cooled machine gun for barrage fire, nor can the latter compare with the former in portability, flexibility, mobility, maneuverability and simplicity.

It becomes then chiefly a question of fire power as compared to the ability to get the weapon to the place where it is needed when it is needed most. The lighter weapons do not sacrifice fire power for a short period of time as they are nearly as capable of intensive fire over a short period of time as the most durable weapons, and it is only when sustained fire power is concerned that they are markedly inferior.

The same mechanism may be utilized in different types of gun the only changes being in the method of cooling. That is, a given gun may be water-cooled as a heavy machine gun, while as a tank or light machine gun it may use a heavy air-cooled barrel in place of a water jacket. The same weapon with a still lighter barrel may be employed as an aircraft weapon.

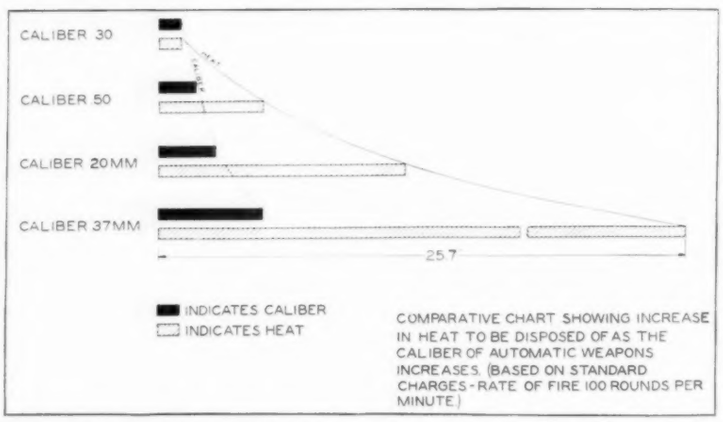
Large Caliber Automatic Weapons using Rifle Type Bullets.—The foregoing chiefly refers to rifle caliber automatic weapons. During and since the World War calibers larger than the modern rifle were used, although using a rifle type of bullet. Such weapons were the 11-mm., 13-mm. and caliber .50 weapons of the World War, and in the latter two cases these weapons are still used.

Intermediate Caliber Automatic Cannon.—Since the World War the calibers of machine guns have been increased so that they are now extensively used in the smaller cannon calibers, in order to meet the attack of aircraft or ground armored vehicles.

The largest caliber machine gun using small arms types of bullets, considering such factors as high cyclic rate of fire, trajectory, weight, size, flexibility, mobility and cooling prob-

lems, appears to be the caliber .50. The smallest intermediate caliber automatitc antiaircraft cannon using artillery types of projectiles, considering the same factors as above, appears to be the 20-mm. types which are so numerous abroad. European nations apparently prefer the 20-mm. types to the caliber .50 type, although the caliber .50 type is very much superior to the 20-mm. with regard to volume of fire, either intensive or sustained.

A Vickers-Maxim 37-mm. was used to a limited extent in the Boer War as a cannon caliber machine gun. It was commonly known as the "Pom Pom," due to the distinctive repetitive sound of firing. This Pom Pom was a Chinese copy of the standard Maxim but of very low velocity. A somewhat similar Pom Pom appeared in the World War on the side of the Germans but with considerably higher velocity, although still too low in velocity to be comparable in effect to single-shot guns of similar caliber. At the present time there is a 40-mm. Vickers automatic gun very similar in design to the machine gun. It fires a high explosive shell with a muzzle velocity of about 2,000 f. s. In the table on page 283 the characteristics of a number of machine gun cannon are shown.


CALIBER 30
CALIBER 50
CALIBER 20MM
CALIBER 37MM
25.7
INDICATES CALIBER
INDICATES HEAT
COMPARATIVE CHART SHOWING INCREASE IN HEAT TO BE DISPOSED OF AS THE CALIBER OF AUTOMATIC WEAPONS INCREASES. (BASED ON STANDARD CHARGES - RATE OF FIRE 100 ROUNDS PER MINUTE.)

Comparison of Ratio of Increase in Caliber to Ratio of Increase in Heat as the Caliber Increases in Automatic Weapons.

THE advantages of increasing the caliber of automatic weapons are so obvious that the cost of obtaining these advantages are overlooked. The larger calibers give great striking energies and in the intermediate automatic cannon allow for the use of explosives. They also provide much better tracing and observation of impacts. However, each small increase in caliber is attended by astonishing increases in the following factors: a, the heat problem, and b, the weight, size and vibration problems.

Numerous attempts have been made to air-cool machine guns so as to not require the use of heavy barrels, changing barrels, or the use of water. These include the use of induced air drafts and the use of turbines operated either by hand or by the muzzle blast. None of these solutions has been satisfactory and the only way that fire can be sustained over a long period of time is by using a considerable amount of water.

As the caliber of automatic weapons increases, the rate of fire possible with this weapon, fortunateley, from the standpoint of dissipation of heat, decreases. This decrease in rate of fire is due to the weight of the moving parts. Even so, the ratio at which the heat increases for a given increase in caliber is much faster than the corresponding ratio of the caliber increase.

If the assumption be made that the heat potential of powder is essentially constant for small arms ammunition, then it will be found that if there are 1,645 British thermal units in a pound of powder, there will be .235 B. T. U. in a grain. It is estimated that somewhere about 18 per cent of the total energy constant of the powder goes to the barrel, this, of course, assuming that barrel lengths, etc., are generally about the same. If it be assumed that 18 per cent of the heat energy constant potential of the powder charge goes to the barrel, then the number of B. T. U.'s per round per grain will be .042 times the weight of the powder charge in grains. The following table [1] shows B. T. U.'s per round to the barrel for various calibers on the assumptions noted herein:

Caliber	B. T. U.'s per round
.22-inch	.11
.30-inch	2.1
.50-inch	10.1
20-mm.	24.0
37-mm.	108.0

Of course, the total heat to the barrel is not only a function of the heat energy to the barrel per round, but also a function of the rate of fire. For example, if it be assumed that the normal rate of fire of the caliber .30 machine gun (actual) is 100 rounds a minute, then at this rate the barrel would receive 210 B. T. U.'s per minute and so on.

If for new weapons the practical rate of fire be assumed at 100 rounds a minute, then the heating effect will be, assuming the caliber .30 to be 100, in accordance with the following table:

Caliber	Heating Effect Index
.22-inch	5
.30-inch	100
.50-inch	480
20-mm.	1140
37-mm.	5140

In other words, if the caliber .30 machine gun be assumed to be 1, the caliber .50 requires 4.8 times as much cooling, the 20-mm. 11.4 times, and the 37-mm. 51.4 times.

As a result of the great heat evolved in firing automatic weapons, erosion is accelerated, with consequent decrease in accuracy life of the barrels. The dissipation of the heat is necessary from the safety standpoint and from the standpoint of durability of the working parts of the gun, but even of more importance is this question of erosion.

AS the caliber increases, the weight, length, size and vibration of an automatic gun also rapidly increases and in a much greater proportion than the increase in caliber would appear to justify. Because of so many variable factors, it is impossible to do more than indicate the increase in these factors by comparative phtographs of the weapons themselves. It is, of course, impossible to make a direct comparison between, say, a semiautomatic and a 37-mm., by reason of the fact that the mission of the two weapons is so different. Also, the semiautomatic rifle is the lightest and smallest caliber .30 automatic mechanism. (No distinction is made between a semiautomatic and a full automatic as the mechanism is the same, the only difference being the design of the sear and trigger mechanism.) The Browning machine gun, caliber .30, M1917 and a well known water cooled 37-mm. might be compared as representative weapons. The 37-mm. weighs

[1] Calculations by J. C. Gray, Ordnance Engineer, Ord. Dept.

Comparison of Typical Machine Gun Cannon

Estimated Proportional Changes in Characteristics of Machine Gun Cannon of Similar Types Based on Increases in Caliber.

Caliber	20-mm. = .79-inch	25-mm. = .984-inch	37-mm. = 1.457-inch	40-mm. = 1.575-inch	47-mm.= 1.85-inch
Muzzle velocity, f.s.	2,700	2,500	2,200	2,000	1,800
Length of gun, calibers	65	60	45	40	33
Type of projectile	A.P. H.E.	A.P. H.E.	A.P.	H.E.	A.P. H.E.
Weight of projectile, lbs.	.309	.458	1.45	2.00	3.3
Fuze	Supersensitive	Supersensitive	Supersensitive	Time	B.D. & S.S.
Pressure, lbs.—sq. in.	50,000	48,000	45,000	40,000	40,000
Type of loading	Automatic	Automatic	Automatic	Automatic	Automatic
Weight of gun, lbs.	143	265	400	600	800
Weight of gun mount, lbs.	628	1543	2000	3000	4000
Maximum rate of fire, per minute	Est. 250	160	100	90	80
Practical rate of fire, per minute	90-100	80-90	70	60	50
Cooling system	Air	Air	Water	Water	Air
No. rounds in magazine	20	12	5 (Clip)	5 (Strip)	5 (Strip)
Type of mechanism	Recoil	Gas	Recoil	Recoil	Recoil
Maximum range, yds.	6,100	6,510	7,000	6,500	6,500
Maximum altitude, yds.	4,100	4,500	5,000	4,500	4,500
Total traverse, degrees	360	360	360	360	360
Maximum elevation,degrees	80	80 A.A.	80	80	80

Note: Existing types of weapons in this country and abroad may excel the above data with regard to muzzle velocity, rates of fire, etc. These figures are considered to be a conservative estimate of practicable designs considering the disadvantages of excessive heat, vibration, etc., for high velocities, rates of fire, etc.

380 lbs. and uses a 5,000-lb. mount, while the caliber .30 weighs 30 lbs. and uses a 50-lb. mount. The rate of fire of the caliber .30 is about 600 rounds per minute, while the rate of fire of the 37-mm. is approximately 100 rounds per minute. Roughly then, the 37-mm. is about five times that of the caliber .30, with the gun weighing 10 times as much, the mount weighing 100 times as much, and yet the rate of fire is but one-sixth.

Vibration in cannon caliber automatic weapons, due to the weight of the moving parts, is very serious. It is due to this that some of the intermediate automatic cannon failed to meet expectations as antiaircraft weapons. The following quotation from an Ordnance study will show the design difficulties in connection with larger caliber automatic weapons.

"With regard to the design of a 37-mm. and its vibration, it is just as desirable to have the path of the center of mass of the recoiling parts when the gun is fired below the prolongation of the center line of the bore of the gun as it is to use other types of design, since experience with other automatic guns in the larger calibers has shown that placing the recoiling parts in prolongation of the center line of bore does not materially reduce the vibration, because the weight of the recoiling parts and the length of travel must be materially increased.

"In the design of automatic mechanisms the choice of breech closure lies between a reciprocating breech closure moving in prolongation of the axis of the bore, a rotary breech block, or a reciprocating breech moving in a path normal to the axis of the bore. In the case of the reciprocating breech block it is necessary that a small locking wedge or other means be provided which must move at right angles to the axis of the bore. Of all the breech mechanisms studied, that which appears to offer the best mechanical solution, both from the point of view of functioning and light weight, is the reciprocating breech closure which moves at right angles to the gun barrel. The path of motion of a side- or down-moving breech closure does not need to be longer than is sufficient to clear the round to be fed. The movement of the breech block can be timed so that its velocity does not have to be high, and the mechanical difficulty of solving the problem is not great. With the regular machine gun type of breech bolt, the travel is necessarily long, because of the fact that the breech bolt must clear the round to be fed, and on account of the long travel the speed must necessarily be high if a reasonably high cyclic rate of fire is to be obtained. The mechanical problem of solving the operation of such a bolt is not difficult, but experience has shown that bolts of this type produce as much vibration as the drop block type. Concerning the rotary breech bolt, no great advantage is seen over the sideways moving bolt. The weights would probably be approximately equal, the velocity of the bolt slightly higher, and the difficulty of mechanical solution somewhat increased." (By J. C. Gray, Ordnance Engineer, Ordnance Department.)

AGAIN assuming that the smallest caliber cannon type machine guns using explosive shells similar in design to standard artillery shell is a 20-mm., and that the largest caliber machine guns using small arms types of bullets is a 13-mm. (caliber .50, approximately), the following conclusions are drawn from the foregoing discussion:

a. The 20-mm. cannon type machine gun has superiority with regard to the effect (moral and material) of its explosive

Vickers Recoil-operated, Water-cooled Automatic Gun.

Hotchkiss Gas-operated, Air-cooled Automatic Gun.

shell and the visibility of its tracer (improved observation).

b. These advantages are offset by the following disadvantages:

1. The weight, size and cost of a 20-mm., both gun and ammunition, are out of all proportion to the increase in caliber and to the superiority obtained. The same thing is true of the difficulty of procurement. The artillery type shells of an intermediate automatic cannon require methods of manufacture similar to those used in the manufacture of artillery shell, whereas a caliber 13-mm. is made by methods similar to those used in the manufacture of rifle and machine gun types of ammunition.

2. The rate of fire, both cyclic and the practical firing rate, of a 20-mm. is not comparable to the caliber .50 inasmuch as the 20-mm. cannot be fixed much more than about 100 rounds per minute, while a caliber 13-mm. is capable of 500 rounds per minute.

3. With regard to sustained fire and the overheating problem, a 20-mm. is markedly inferior to a caliber 13-mm. inasmuch as it is not believed that over 100 rounds in one minute could be fired in a 20-mm. before the barrel would be too hot for further firing without loss of accuracy, while a caliber 13-mm. heavy barrel type will stand several hundred rounds per minute. The comparison is for air-cooled barrels.

4. The usual feed mechanism requiring 20-round magazines in a 20-mm. means an interruption of fire at close intervals, while a belt fed 13-mm. allows continuous fire. Continuous fire, or at least long bursts of fire, is important when ranging with tracer ammunition on rapidly moving targets. It is difficult to use belts for calibers larger than 13-mm.

Fire from automatic weapons produces patterns somewhat different from the patterns which would be obtained from a single-shot weapon firing the same number of rounds (particularly in the fast firing rifle and machine gun caliber weapons). Fire from automatic weapons is so rapid that weather conditions, particularly the wind, have an almost simultaneous effect on the size of the pattern and, in so far as the width and length of the pattern or beaten zone is concerned, it is negligible. The most important effect on dispersion is the vibration of the gun due to recoil. This invariably lengthens the beaten zone on a horizontal plane compared to that which would be obtained by firing single shots.

A machine gun, contrary to popular opinion, is not like a hose and cannot be used like a hose except at the very shortest ranges, because while a hose has a continuous stream of water, bullets from caliber .30 automatic weapons are about 100 yards apart for the ground gun and several hundred yards apart in the larger, slower firing automatic cannon. If the gun is used as a hose, the density of hits per unit area decreases to an extent which makes effective fire impossible.

Conclusions.—The desirability of choosing a cannon caliber machine gun in place of small arms caliber type machine guns depends upon the relative importance assigned to the various advantages and disadvantages of the two types, for in the end you pay for what you get.

If *volume* of fire is considered to be the number of rounds per minute which can actually be *sustained,* and if *shock* is considered to be the effect of each shell or bullet, it follows that: *a.* Simplicity and flexibility are obtained at the sacrifice of *volume; b. Volume* is obtained at the sacrifice of *shock; c.* Light weight, simple weapons can only be used at the sacrifice of both *volume* and *shock.*

A definite mission may require volume or shock or both; on the other hand, it may demand a simple light weapon even at the loss of both shock and volume. All of which comes back to the fact that you cannot have your cake and eat it too.

Disarmament and Defense

We Must Get Back to Realities to Avoid Another World War

By Sir Charles Petrie*

THERE are few subjects about which there is so much muddled thinking at the present time as disarmament. The natural reaction against the horrors of the World War has caused many people to see in the mere existence of the armies, navies and air forces of the various Powers a threat to peace, and this, in its turn, has led them to call for the abolition of all armaments, save those that are necessary for police purposes. Without impugning the motives of those who take this view, it may safely be asserted that they are regarding the problem from the wrong perspective. It is not armaments that cause war, but the policy of governments (and, it may be added, the psychology of peoples in which unreasoning fear plays no small part): and if disarmament is to be effected it is first of all necessary to secure such a measure of agreement between the leading Powers as to remove the fear which they now entertain of one another. France and Germany are not, for example, kept apart by their military preparations, but by the lack of confidence in each other's intentions of which those preparations are the symbol.

Then, again, it is no uncommon thing to hear pacifist arguments based upon the carnage which modern armaments can effect. This line of reasoning, too, is beside the point, for the prospective horrors of warfare have never yet deterred mankind from embarking upon it. The invention of gunpowder was followed, not by a period of peace, but by a long series of wars, and the submarine, airplane, and gas are not likely to have any different effect upon the history of the world. This question of disarmament is not going to be settled either by confusing cause and effect, or by appeals to sentiment, or by the liberal use of catchwords, which are only too often employed to conceal the absence of constructive thought on the part of those who utter them. All three methods have been tried for fifteen years, and the international situation today is the best commentary upon their futility. If we want to avoid another outbreak on the scale of the last we must get back to realities.

Unilateral disarmament is useless, and may become dangerous. Great Britain has disarmed in the hope of persuading others to follow her example, but they have not done so, and the result is that she is now so weak as soon to invite attack unless the present policy is speedily reversed. It is too often forgotten by British statesmen that there are enough pickings on the carcass of the British Empire to satisfy the appetites of the most voracious European and Oriental Powers. Similarly, the unprotected condition of the American possessions in the Pacific is a threat to, rather than a guarantee of, peace in the Far East. The manifest inability of Austria to withstand Germany unaided is one of the principal factors in the unrest in Central Europe, while it is to the evident capacity of Poland to defend herself that is due the improvement of her relations with Berlin. Weak nations, with insufficient armaments to protect themselves, are a standing temptation to their neighbors, and so are a potential cause of war. There was no Far Eastern Question until China began to decay.

DEFENSE and defiance are relative, not absolute, terms. A nation with frontiers that are easy to defend and without overseas commitments, Switzerland for example, can be content with much smaller forces than one, such as Holland, that has open frontiers and colonial possessions. From this it follows that if a Power in the former category were to amass the armaments essential to one in the latter, the point would have been reached where defense of itself had become defiance of its neighbors. If Great Britain were to maintain an army the size of the French, or France to build a navy equal to the British, either act would constitute a definite threat, and when, in the past, the attempt has been made it has been rightly regarded as such. The pre-war German army was not, in the circumstances of the time, excessive, and it is significant that it was not until the passage of the Navy Acts that war, at any rate with Great Britain, became inevitable: the maintenance of a large German navy was quite unnecessary for the purposes of defense, and so was an act of defiance. Mexico has roughly the same population as Yugoslavia, but if she, who is not threatened from any quarter, maintained an army of the same size as that which obeys King Alexander, whose dominions are exposed on all sides, the United States would be justified in treating such a state of affairs as a threat, and in taking the necessary steps to meet it.

This argument would appear self-evident, but those who attend disarmament conferences have an unfortunate knack of missing the obvious. Nations have different needs in the matter of armaments, as of tariffs, and it is just as absurd to fix arbitrarily the exact number of cruisers, airplanes, and tanks that each Power shall possess, as it would be to say that the British, French, and American duties upon imported foodstuffs must be the same. The attempt to measure national needs with the same rule has been the principal cause of the slow progress hitherto made with disarmament on the technical side. There has been remarkable unanimity in advocating the abolition of what is obsolescent, and of what, like the battleship, is becoming too expensive for a world across which the economic blizzard is sweeping; but so long as no allowance is made for individual requirements that is so far as any conference is likely to get. When the world's statesmen assemble in such conclaves they invariably commence their proceedings with speeches full of high-sounding phrases which pay lip-service to the cause which they are supposed to be met to advance, and the Press, particularly in the Anglo-Saxon countries where journalists appear to be more gullible than elsewhere, at once announces a "new era," hails "a fresh dawn," or declares that the world has turned a "new page." The next step is the preparation of a memorandum by each delegation, and when this is published it is found to contain an elaborate scheme for the disarmament of the immediate neighbors of the Power by whose representative it has been drafted. The British plan will advocate the abolition of the submarine, which threatens the foodships upon which her very existence depends; the French will call for the condemnation of the battleship, with which they have never been

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successful, and which they cannot now afford; and so on. The upshot, after weeks or months of talk, is either a compromise, which takes the matter no further forward, or the adjournment of the whole problem to another conference.

A further weakness of the attempt to secure disarmament is that it has too often been made under the auspices of the League of Nations, and even the most enthusiastic supporters of that institution must admit that so long as it is committed to the maintenance of the *status quo* established by the Peace Treaties it can hardly regulate the world's armaments in an impartial manner. Quite apart from the incompetence displayed by Sir John Simon at the time that Germany left Geneva, it is difficult to see how that country could have continued to argue its case before judges who were also potential counsel, in another capacity, for its opponents in the late war. If the League wishes, first of all to attract to herself that majority of Great Powers which no longer recognizes her, and, secondly, to further the cause of disarmament, it must be disassociated from the Peace Treaties, and everything for which they stand. Let the settlement of 1919-20 be a private matter between those who made it, with reference, in the event of disagreement, to the Permanent Court of International Justice at The Hague, and let the League deal with the future, rather than the past. Otherwise, the existing vicious circle of Disarmament—Peace Treaties—War Mentality—Armaments—Disarmament will never be broken.

IN the effort to avoid facing the fact that policy controls armaments, and not armaments policy, the suggestion has been made that it is possible to discriminate between weapons of offense and defense. With this end in view the advisability of disarmament upon such a basis has been seriously argued. Apart, however, from the inherent difficulty of making an arbitrary distinction of this nature, the requirements of the various nations are widely different. As in the case of quantity, so in that of quality. A type of weapon which in the hands of one Power might be defensive, could well have definitely offensive potentialities in those of another. The smaller States, for example, regard the submarine as essentially a weapon of defense, while the larger ones, with their lines of communication across the seven seas, look upon the matter from a diametrically opposed standpoint. Discrimination is but a further tinkering with the problem, for if all guns over a certain caliber were prohibited by an international agreement, those that were permitted would soon become a menace in their turn. It would be the case of the German "pocket battleships" all over again, where the vengeance of the conqueror has been thwarted by the skill of the engineer, and the precautions of the statesman would meet with the same fate.

An aspect of the question which is too often ignored by pacifists and sentimentalists is that a regular annual outlay upon armaments is a form of protection for the iron, steel, and allied industries. In Great Britain, even in the heyday of Free Trade, these trades were always able to compete with their foreign rivals because they could rely upon a certain amount of naval construction each year. Since the war, and the decay into which the British Navy has fallen, they have declined to such an extent that even the new tariff has not been sufficient to revive them. Nor has the taxpayer been saved anything, for he has to find the money for the dole; in other words, he now has to pay to keep men in idleness instead of at work. Of course the reply which is always made to this line of reasoning is to assert that expenditure upon armaments is unproductive; but is it? The bulk of the money goes in wages, and now that it is generally admitted that the State has a duty to its citizens if they are out of work, this criticism is no longer to the point. The cost of a cruiser of the Washington class is equivalent roughly to that of thirty cargo vessels of 8,000 tons each, but owing to the increase in scientific and mechanical appliances in warships the spread of benefit away from the shipyard areas is greater than would be the case with cargo boats. Surely the only unproductive, if necessary, expenditure today is that which goes to the unemployed, and whatever may have been the case in Ruskin's time it surely cannot now be argued that money spent in wages is unproductive, when the only alternative is spending it on the dole. As has already been suggested, there is far too much sentimentality and loose talking in the matter of armaments.

It is obviously necessary that for the purposes of defense each nation should possess both the machinery and the experience to produce the armaments it requires, and this is a fact that the sentimentalists ignore. They behave as if armies and navies can be improvised at a moment's notice like rabbits out of a hat. Yet unless the plant and the skill are developed in time of peace, when war comes it will be too late. Of course when there is no danger of war ever again taking place the matter will have a different complexion, but in spite of the Pacts to the contrary, that time is not yet. During the operations between Japan and China pacifist busybodies persuaded the British Government to place an embargo upon the export of arms to the belligerents. The immediate effect of this was to aid the Japanese, who could manufacture their own munitions, as against the Chinese, who could not, which was certainly not the intention of those who were responsible for the embargo; while the ultimate consequence has been the diversion of orders for armaments from Great Britain to her rivals, for the reason that no one will deal with a country which may prohibit the delivery of goods ordered at the very moment when they are most wanted. The private manufacture of armaments is another bugbear of the pacifist, and from time to time the most lurid pictures are painted of those engaged in this industry combining with newspaper proprietors to inflame public opinion for their private gain. Not one shred of reliable evidence has ever been produced in support of these allegations, and unless armaments are to be regarded as evil in themselves, like opium, there would not appear to be any reason for forbidding their private manufacture.

FROM whatever aspect this problem of disarmament is regarded it is seen to be political, not technical. To treat it in any other way is but to tinker with the plumbing of a house of which the very foundations are giving way. Mere numbers of men, and mere strength in armaments, will not guarantee security. The Roman Empire, in all its vast extent, was effectively defended for centuries by an army of about the same size as that maintained at the present time by France alone. In effect, armed strength is relative to time and place, and a glance at the political condition of the world today will go far to show that the question of disarmament is everywhere subordinate to policy.

Europe lies under the shadow of the suspicion which France and Germany entertain of one another's intentions, and this is at the root of all the trouble in the Old World.

France, with the most elaborate system of frontier defenses ever devised, does not feel safe even in the face of a Germany with an army limited by the Treaty of Versailles to 100,000 men, and deprived of tanks, heavy guns, and airplanes. She has a feeling that the German professional army is potentially superior to her own conscripts, and yet she dares not imitate the methods of her neighbor for fear of a military *coup d'état* which would overturn the Third Republic. The Powers of the Little Entente—Czechoslovakia, Yugoslavia and Rumania—all keep up military establishments which they cannot afford because they are afraid that if the latter were reduced either the alien minorities within their borders, or their late enemies, would take advantage of the opportunity to upset forcibly the settlement of fifteen years ago. Poland, situated between Germany and Russia, is armed to the teeth for fear of aggression either on the part of Berlin or Moscow, and even Denmark, which a few years ago was seriously considering the reduction of her army to a mere skeleton force, is now engaged in strengthening her frontier with Germany. No one can travel in Europe without being conscious that all these military preparations are the result of the prevailing political tension. There can be no disarmament without real peace, and that is impossible while a feeling of injustice rankles in so many millions of hearts.

The only statesman who seems to have realized these facts is Mussolini, for the others have been content to go on attempting to put the cart before the horse, that is to say disarmament before a general pacification. The Four Power Pact may not be much to the liking of those who still pin all their faith to Geneva, but even they can hardly deny that if Great Britain, France, and Germany came to an agreement on the matters that most concern them there would be a definite relaxing of the tension, and a consequent rapid reduction in armaments. If Russia can be included in any such scheme, and this is what Mussolini now seems to have in mind, so much the better. The important thing is to have real peace, and it does not matter in the least whether this is secured at Geneva or Rome. The League has always had more to fear from its friends than from its enemies, and just as there are Frenchmen who would rather see the rest of the world re-arm than their own country disarm, so there are misguided enthusiasts who would appear to prefer the indefinite prolongation of the existing state of affairs, with war as the inevitable outcome, rather than have a settlement effected save through the instrumentality of the League of Nations. Happily, there are signs that Mussolini's attitude is commanding an increasing amount of support, and if once it is frankly admitted that the problem of disarmament is primarily political it will be well on the way to being settled.

THE other great storm center of the world is the Far East, and the same observation holds true. There is not the slightest reason why hundreds of thousands, possibly millions, of men should be under arms in that quarter of the globe if only the Powers concerned would follow a policy fitted to the circumstances of the case. At the present moment Great Britain and the United States are so weak there that they are actually, though not intentionally, encouraging the militarist element in Japan. The first step must be that Hong Kong and the Philippines are put into an adequate state of defense, and then Tokyo can be approached with a view to a definite settlement of the Far Eastern Question. It is certainly not going to be settled by declaiming against Japan as a menace to all Asia, while at the same time disarming ourselves to such an extent that she has it in her power to become just such a menace whenever she wishes. It will not be until the Great Powers are on a more equal footing in the Far East that it will be possible to talk peace, but when once this has taken place real, as opposed to unilateral, disarmament will follow. It is more easy to persuade a man to throw away his gun if you have one to throw too, than if you have only a stick in your hand, which is what Great Britain has been doing in Europe for the past ten years.

There is a widespread idea at the present time that firmness in international matters must of necessity lead to war, and that it is therefore better to compromise upon all and every occasion. Nothing could be further from the truth. The ablest Foreign Secretary that Great Britain ever had, namely, George Canning, was also the firmest, and not a shot was fired from a British gun while he was in office. The moral of this is applicable in the Far East today. Japan will be quick to see the significance of such steps as have been mentioned, and far from leading to war, they are the only way of preventing it.

All considerations thus lead us back to the point at which we began, namely, that armaments cannot be regarded as a thing apart. To do so is as if a doctor were to treat an internal malady, which produced some cutaneous eruption, as a skin disease, without ever trying to find out what was the real cause of the malady. The problem is not susceptible of such amateur treatment, and the ultimate solution will probably be found to lie in allowing each nation to arm according to its needs, and it will be for the statesmen—who are truly worthy of the name—to see that these needs are small.

Engines for Fighting Tanks

Their Special Nature Requires Special Designs

By George H. Rarey*

A REVIEW of tank engine requirements indicates the necessity for developing special engines for fighting tanks. It is the writer's belief that this course is logical and as necessary as it is to provide engines of special design for other motor vehicles.

Engines designed especially for airplanes, automobiles, trucks, tractors, and boats are not generally suitable for interchangeable installation among these vehicles because the engine characteristics for each vehicle are quite different. While it is possible to use some of these engines in tanks, none of the engines now being used in ordinary motor vehicles are entirely suited to tank use for the same reason that they are not suitable for exchange among the vehicles named, viz.: the fighting tank, like each of the vehicles listed, is a special vehicle, the tank engine operates under conditions different from and more severe than other automotive vehicles and the characteristics of an engine well suited to tank use are different from those of any of the engines built for other special vehicles.

A GREAT deal of progress has been made in engine design since engines were installed in the first fighting tank in 1916. This first tank was powered by two Daimler, vertical, sleeve-valve, 6-cylinder, 105-h. p. (at 1,000 r. p. m.), water-cooled, gas engines. These engines operated tanks weighing about 31 tons and provided a total h. p. per ton (tank weight) of only about 3.4. Therefore, the tank was slow, its high speed being about 3.75 m. p. h., it had poor climbing ability and was incapable of the bursts of speed needed by fighting tanks.

The development of the first tank was a case where, due to the war-time need for production of tanks and other vehicles, an engine already in production *was made to serve a purpose which was vastly different from that for which the engine was intended* and, in practically all tanks built to date, with a very few exceptions, tank designers have followed this first example and attempted to use truck, automobile, marine and airplane engines as tank power plants.

It was soon recognized that the first tanks were underpowered and a small increase in power was secured by modifications to the engine such as increased compression, reduction in the inertia of the reciprocating parts by the use of aluminum pistons, and by increasing the r. p. m., until the Daimler was made to deliver about 125 h. p.

The first special British tank engine was designed by Mr. H. Ricardo. The requirements outlined for this engine were as follows: It was to have six cylinders; to develop 150 h. p.; to operate when tilted at an angle of 35 degrees in any direction, without producing a smoky exhaust and without defective lubrication; to run 100 hours without adjustment of bearings or tappets; to use low grade fuel; the use of high tension steel and other materials required for aircraft was to be kept at a minimum; the width of the engine was limited, the length was considered less important. The height was almost unrestricted. Taking advantage of the height at his disposal the designer used a long stroke and adopted a plan to carry the upper end of the connecting rod in a cross-head guide. This kept the chief seat of friction free from excessive heat, simplified its lubrication, prevented an excess of oil from causing smoky exhaust and permitted a free-fitting piston head to be used without causing "slap" when it was cold. Only 186 lbs. per square inch of compression was used and at 1,200 r. p. m. this engine delivered 165 h. p. However, as the weight of the new British tanks in which these engines were used was increased, the h. p. per ton of these tanks was not materially increased. Later a Ricardo 6-cylinder engine of 225 h. p. was built, and in spite of a further increase in tank weight to 39 tons, this engine provided 5.9 h. p. per ton. This was worth while but the tanks were still very much underpowered.

For U. S. tanks 15 to 18 h. p. per ton for continuous operation and 25 to 30 h. p. per ton, for short periods of 30 minutes to one hour, are desirable. These requirements are based upon the special job that the tank is called upon to perform. In other words, the mission of the tank engine, together with the unusual nature of its installation and the conditions under which it must work are such that a large reserve power is necessary and a specially designed engine is very desirable. Such an engine is considered as necessary for the combat tank as is the specially designed truck engine for trucks, or the special design of engines for other vehicles.

The demand for a large reserve power is justified by the job or mission given to the tank. The tank is not an ordinary motor vehicle. It is a fighting vehicle, it has great weight, it must operate across rough terrain; go through swamps, brush, wire obstacles, deep mud, sand; climb steep grades; crush trees; cross small streams, brick and cement walls, railroad tracks, logs, shell holes, ditches and trenches. The same vehicle must be capable of moving at a good speed on small and medium grades, and at higher speeds on level ground. Many unexpected obstacles are encountered by the fighting tank and its engine must frequently exert its full power to supply the speed or the climbing ability required by the crew.

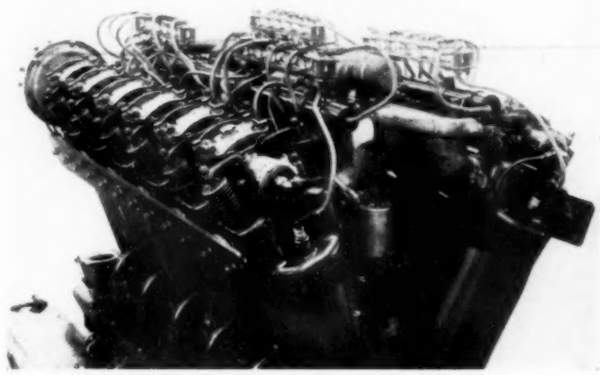
In action, the tank crew cannot always choose the exact route over which it will move as the ground under enemy control cannot be reconnoitered in advance of the action. Artillery fire, drainage lines and antitank obstacles provide frequent unforeseen emergencies which call for great maneuverability and agility on the part of the tank. These qualities call for a large reserve of power.

The fire of antitank guns will be less effective if the tank engine has sufficient power to carry the tank up slopes and over the crests of hills at a good speed. The T-3 Christie tank made 20 m. p. h. on a short 10 per cent slope on its official test. This tank is powered with the Liberty engine which provides about 30 h. p. per ton. Its cross-country performance is superior to that of any other tank or tractor tested by the tank service to date and its road speed equals that of the

*Fort Benning, Georgia. Author (with Jones and Icks): "The Fighting Tanks Since 1916." Captain, Infantry, U. S. Army.

armored car. While it is true that certain other features of this vehicle contribute to its exceptional mobility, its great reserve of power is one of the two predominant factors in its unusual performance.

In addition to the performance made possible by providing a large reserve of power, engine depreciation is reduced because the engine is able to operate the tank a good part of the



THE LIBERTY ENGINE—POWER PLANT OF THE MARK VIII TANK.

time at a fairly low speed and at a reduced engine speed, thus materially reducing the cooling and lubrication difficulties which usually attend the operation of tank engines at or close to their highest speed.

The facts pertaining to the reserve power requirements have not been given consideration commensurate with their importance in the past, hence the general tendency has been to underpower the tanks. The attempt to use engines designed for other vehicles as tank power plants has contributed to this condition in many instances.

FROM the previous statement concerning the work to be demanded of the tank engine, it is apparent that a heavy duty engine with good torque or lugging ability at the lower and medium speed ranges is desirable. In operating a track vehicle across country many changes in direction are made and gears must frequently be shifted if the terrain is rough. Sharp changes in direction cannot be made at high speed.[1] The speed is reduced and, in some cases, the tank must be practically stopped to make a 90 degree turn. If the engine does not have good torque at low and medium engine speeds, the "get away" after the change in direction has been accomplished is not what it should be.

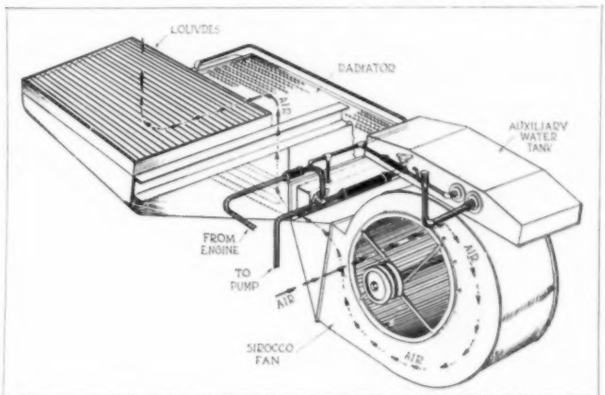
Most tanks will practically stop during the shifting of gears and trouble is again experienced in getting under way without killing the engine, if a high speed engine is used.

While engines of higher r. p. m. are used in some tanks, it is believed better to put the high limit at 2,000 for the above reasons as well as for cooling and lubrication efficiency of an engine which must be enclosed in armor. The Liberty 12-cylinder engine, now used in the 44-ton Mark VIII tank and in the 11¼-ton T-3 Christie tank, develops 338 h. p. at 1,400 r. p. m., its governed speed. This is a 5-inch bore by 7-inch stroke, 1,649.34-cubic inch engine. While it is not a heavy duty engine and the supply of these engines has been exhausted by use and sale, the Liberty engine was one of the best tank engines tested by the Tank Service.

[1]Considerable improvement in making turns at higher speeds is expected through the use of the controlled differential recently tested by the Ordnance Department.

CONTRARY to a somewhat general belief, the weight of the tank engine is an important factor. This is due, in part, to the fact that the engine must be installed at one end, preferably at the rear end of the tank hull and, in case a very heavy engine is used, the tank center of gravity is moved too far to the rear. This adversely affects the maneuvering ability of the tank.

Aside from its effect upon the location of the center of gravity, the weight of the engine is important in its effect upon the total weight of the tank as the total weight, in turn, has such an important bearing upon the mobility of the tank. Hence we favor the reduction in weight of the engine and all other mechanical units in the tank to the minimum practicable limits. The Liberty engine mentioned above weighs about 3.6 pounds per maximum h. p. developed and it should be noted that this ratio is attained at the comparatively low engine speed of 1,400 r. p. m. It is believed that there are not many engines which approach this figure, unless the radial type be considered. Radial engines, however, have not been considered well suited to tank use due to the cooling difficulties with this type of engine when installed in the tank. The radial airplane engine is usually a high speed engine and, while it is not impossible to cool it, the h. p. loss sustained in cooling this type in a tank may, as predicted by the Wright Aeronautical Company and, as demonstrated in recent governmental experiments, run very high. On the other hand, it is true that the relatively small space required for the radial



COOLING SYSTEM USED WITH THE LIBERTY ENGINE IN THE MARK VIII TANK.

engine is an important point in favor of this type and another point of almost equal importance is its small amount of weight per horse power.

Considering only the in-line, vertical, the V, the horizontal and the horizontally-opposed engines, it is believed that a maximum weight of 5 lbs. per h. p. is the extreme high limit and that, in every case, it would be desirable to reduce this figure as much as possible.

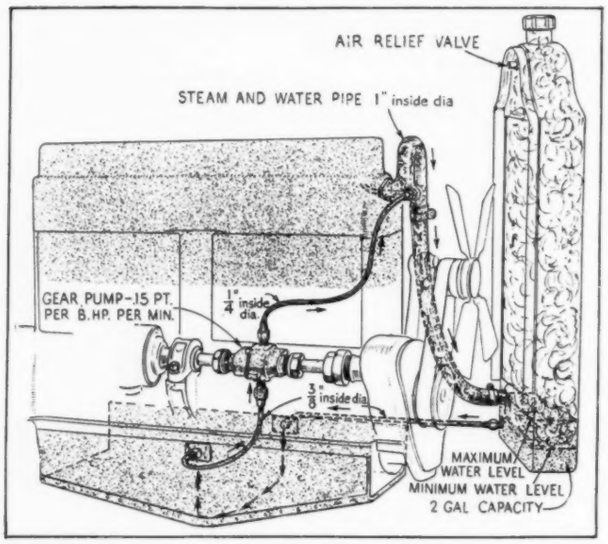
SPACE in the tank is at a premium so engine bulk is an important factor. A long engine will necessitate the reduction of the space needed for crew and weapons, supplies, etc., or the building of a long tank hull. Increased length of hull causes the lengthening of the tracks, as they must be longer than the hull, and the long tracks adversely affect the turning ability and mobility of the tank. We need short engines. Consequently the Vee and the horizontally opposed types are best suited to tank use.

Width is not so important as length. It is no longer neces-

sary or desirable to build tanks so poor in mechanical efficiency and mobility that they must be carried on trucks from one field of action to the next. Since Mr. Walter Christie produced his very simple and efficient suspension system and demonstrated the value of great reserve power, the carrying of tanks is out of date. Consequently, the width of the light tank need no longer be restricted by the width of the truck body as was the standard 6-ton tank which, due to this limitation, had the width of the engine room reduced to about 36 inches inside measurement. It is in fact desirable to build wider tanks in order that their stability on side slopes may be increased and in order to secure additional space for the mechanical units, equipment and crew, without having an excessively long or high tank. The peacetime limitation of 96 inches overall width should not be applied to medium tanks as it unduly restricts the space needed in the fighting compartment for crew and weapons.

It is very desirable to use a low engine as a tank power plant because we may, by this means, reduce the overall height of the engine room and, consequently, the size of the target presented by the tank. For this important reason the horizontally opposed type is by far the best.

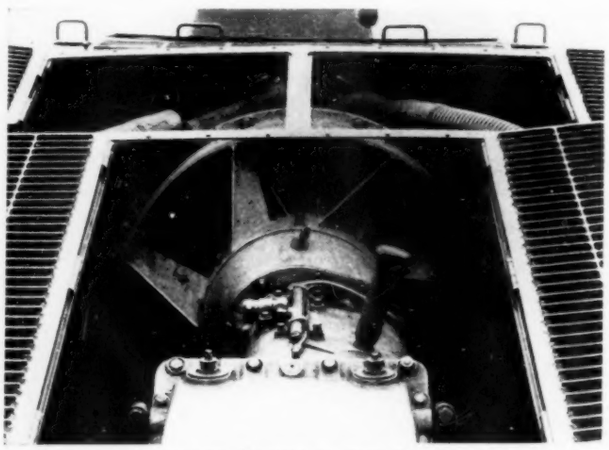
ENGINE cooling has been a difficult problem because the tank engine operates under adverse conditions which are not duplicated in any other land motor vehicle. As the tank engine is entirely enclosed in armor it receives no benefit from


AIR RELIEF VALVE
STEAM AND WATER PIPE 1" inside dia
GEAR PUMP-15 PT. PER B.HP. PER MIN.
1/4" inside dia
3/8" inside dia
MAXIMUM WATER LEVEL
MINIMUM WATER LEVEL
2 GAL CAPACITY

General Arrangement of the Rushmore Steam Cooling System showing Oil Pan Jacket Heated by Water from Tank at Bottom of Condenser.

the rush of air due to the movement of the vehicle as does the automobile, truck, or airplane engine; and the hot air in the engine room cannot be forced out as easily as in the case of other motor vehicles. As far as engine cooling is concerned, no motor vehicle presents a more difficult problem than the tank. The engine may be ever so good, but if the cooling system fails to operate efficiently, the tank will stop or its speed will be so reduced that it will be ineffective as a fighting vehicle. Most of the tanks that have been developed up to the present time have used the forced water-cooling system. A few have used the thermo-syphon water system. In several cases, the air-cooling system has been applied to tanks in an effort to get away from the cooling troubles incidental to the use of radiators, water pipes, water pumps and water.

Faulty cooling system design has been responsible for some of the difficulties connected with engine cooling on some tanks. Some designers have taken the hot air from the engine room and forced it through the radiator in an attempt to cool the hot water therein. Others arrange to use the cool air from



Radial Air-cooled Engine in the Combat Car, T4.

the outside of the tank to cool the water in the radiator and of the two methods, the latter is the more efficient. Poorly designed radiators, lack of provision for the air blast from the fan to strike all of the radiator tubes, small air entrance and air exit openings, etc., have decreased the efficiency of water-cooling systems. The cooling system must be efficient regardless of weather conditions.

As to steam cooling—to use this type of cooling in any vehicle it is necessary that there be sufficient cool air inside the vehicle (passing through the radiator) to keep up a continuous condensation and return of the steam being formed, to a liquid state. This can be accomplished in a vehicle which operates at a high rate of speed, as the natural air flow through the radiator supplements the fan-induced air flow and successfully condenses the steam as fast as it is formed and delivered to the radiator. It is believed that this system can be successfully used on a tank but its installation will be much more difficult than on the automobile. Even if it successfully cools the engine, such a system retains all the potential causes for failure inherent in radiators, pumps, belt-driven fans, pipes, hose connections, leaks and freezing in winter and lack of water supply in some localities.

A MORE efficient cooling system for the tank than is supplied by the water system is desirable and, although we can use the water-cooling system in trucks, tractors, and passenger cars in a country well supplied with water, each of these vehicles would be materially improved for our purposes, if they were equipped with a cooling system that uses no water or other liquid which can leak, freeze, or steam.

An officer who had been responsible for the operation of a large pool of motor transportation in France during the War, was asked the following question: "What feature or unit of your trucks and other vehicles gave the most trouble?" Without a moment's hesitation he replied: "The water-cooling systems." Being asked for details, he stated that most of the difficulties were caused by steaming radiators in hot weather, frozen radiators and pumps in cold weather, accidents to

radiators causing leaks, leaking water pumps, leaking hose connections, and the replenishment of the cooling medium from unclean pools of water along the roadside.

An excellent study of cooling system troubles, published in *Motor*, listed fifty engine troubles arising from various causes which may result in the failure of cooling systems. A check of this list showed nineteen items, or 38 per cent of the total, caused by the use of water as a cooling medium. These 19 troubles can positively be eliminated by the use of air-cooling, and when any of the troubles incidental to the operation of motor vehicles are eliminated, motor transportation becomes proportionately more efficient.

Taking our standard light tank as an example of the difficulties encountered with water-cooling in this type of motor vehicle, the following list shows the potential chances for the vehicle to fail, as a result of the failure of the cooling system:

1. Decrease of the cooling medium on account of leaks: (a) Leaks through the water pump grease cups, of which there are two; (b) Leaks through the packing gland nut; (c) Leaks due to the lack of water pump shaft packing; (d) Leaks due to the loss of the two grease cups, through vibration; (e) Leaks due to the accumulation of steam and its escape through the overflow; (f) Leaks due to the blowing out of a gasket in the water pipe flange; (g) Leaks through any of the four hose connections due to the loosing of either one of the two clamps on each connection; (h) Leaks due to the radiator being punctured by a bullet, after coming through the armor plate; (i) Leaks through any one of the 1,324 radiator tubes, due to the tubes being loosened, or due to the tubes being damaged by freezing.

2. Lack of circulation of the cooling medium—due to: (a) Shearing of parts of the pump drive; (b) Broken impeller blades; (c) Buckling of the hose connections; (d) Ice forming in the cooling system; (e) Foreign matter being put into the system with unclean water.

3. Lack of cooling air for the radiator—due to: (a) Broken fan belt; (b) Slipping fan belt; (c) Failure of the cooling air to strike all radiator tubes; (d) Inadequate supply of air being drawn into the engine room.

ANOTHER example of an inadequate cooling system is found in the standard Mark VIII tank which is powered with the Liberty 12, V-type, water-cooled, airplane engine. There are 38 hose connections in this cooling system, each of which is held in place by two hose clamps. The cooling water passes through many pipes, in addition to the restricted passages in the water jackets to reach the point around the cylinder heads where the cooling action is most needed. A large, horizontally-mounted 606 tube radiator is placed in an air duct through which the cooling air passes. The water is passed through the radiator twice in one circulation, that is, it passes through the tubes in the upper half of the radiator to the rear end, and then back through the tubes in the lower half to the forward end of the radiator on its way back to the engine.

A 24-inch Sirocco fan is used to circulate the cooling air. This fan delivers 11,000 cubic feet of air per minute at an engine speed of 1,400 r. p. m. It is driven by a silent chain from the engine shaft to a bevel gear set, through the bevel gears and by means of pulleys and a leather belt to the fan shaft. The fan is mounted close to one side of the engine. It draws hot air from the engine and the red hot exhaust manifolds directly into the fan housing, hence the air intended for cooling purposes has absorbed a great amount of heat before it reaches the radiator. The Mark VIII cooling system has been materially improved by recent modifications but it still has all the potential chances for failure which are inherent in all water-cooling systems.

Another objection to the use of water-cooling systems in tanks is the usual lack of suitable water on the battlefield for engine-cooling purposes. This condition would necessitate the hauling of the cooling water from a distance and water would thus become an item of supply for the fighting tanks. Each of our standard light tank cooling systems requires al-

BY-PRODUCTS OF THE WATER-COOLING SYSTEMS IN MILITARY VEHICLES. RADIATORS AWAITING REPAIR NEAR THE WESTERN FRONT.

most nine gallons and each of our heavy tanks requires thirty-nine gallons for cooling purposes. With continuous operation these systems may lose a large part of this supply, in which case the amount lost must be replaced or the vehicle must stop. In an arid country the use of water-cooled tanks and other vehicles might place a restriction upon the employment of these vehicles. To provide water for a great number of engines would be a supply problem of some magnitude in certain localities. The same objections apply to any of the chemical liquids recently developed for engine cooling. The problems incidental to the supply of an army in the field should not be further increased by adding new items such as water or chemicals for engine-cooling purposes.

On the other hand, the cooling medium used by the air-cooled engine is always available. It needs only to be put into circulation to accomplish the cooling job efficiently and it requires no radiator, pumps, pipes or hose connections. There is nothing to haul, fill, drain, freeze, boil, rust, leak or lubricate in this cooling system, and no fan belt to slip or break, as the cooling fan is fastened directly to the crankshaft of the engine. In addition to the other water-cooling handicaps mentioned, the water-cooling system necessitates the provision of space for a large radiator which is not required with an air-cooling system.

Classified according to the job for which they were designed; truck engines, automobile engines, airplane engines and marine engines have been used in tanks. Classified as

to motive power; gas engines, gas-electric power plants, and steam engines have been used. Lately, Diesel engines are being used experimentally in Europe. Owing to the inherent advantages of the Diesel engine it gives promise of the greatest efficiency as a tank engine for the following reasons: (1) It is easier to cool than the gas engine. (2) Its radius of action on a given number of gallons of fuel will be greater than that of the gas engine. (3) The fire hazard is very great in the case of the gas engine and practically nil in the case of the Diesel. The danger of fire in the tanks is a very real one, especially if the tank is struck by a shell. A great many tanks and some tank crews were destroyed by gasoline fires during the World War. (4) The ignition equipment needed by the gas engine, a source of potential trouble, is eliminated by the Diesel, and in this elimination, entire freedom from radio interference is secured. This is an important advantage. The present handicaps of the Diesel, such as weight, size and a tendency to have a smoky exhaust, all appear to be susceptible of improvement.

THE gas-electric power plant has much to recommend it to tank operators and the French have used it quite extensively in their heavy tanks. However, the actual motive power being derived from the same source as an ordinary gas power plant, the same objections apply to the gas-electric as to the ordinary gas engine. A very large percentage of the French tank casualties (burned tanks) during the war were gas-electric tanks.

The remarkable power developed by the steam engine makes it an attractive possibility for a vehicle such as a fighting tank which needs a great power reserve. However, the bulky steam boilers require much space and some of the handicaps mentioned in the discussion of water cooling would apply to the steam power plant. Danger to the crew from live steam has been given as one reason for not using steam engines but this hazard is not believed to be any worse than the ever-present gasoline fire hazard in a gas-driven tank.

In view of the special nature of the job performed by the tank engine and the unusual conditions under which it must work, the following items appear to be among the important general specifications of a special tank engine, from the viewpoint of the tank operating service: 1st, The engine should be built to fit the job. 2nd, It should develop 25 to 30 h. p. per ton weight of the tank which it is to operate. 3rd, Its maximum output should be attained at not over 2,000 r. p. m. 4th, It should have good torque at low and medium engine speeds. 5th, It should not weigh over 5 lbs. per h. p. and should weigh less. 6th, It should be of the horizontally-opposed type. 7th, It should be air-cooled. 8th, It should be a Diesel engine. 9th, It must be capable of operating in a cloud of dust continuously without undue depreciation. 10th, In order to provide a factor of safety in operation the engine must be governed at a speed below that at which cooling and lubrication is imperfect. 11th, To increase efficiency of lubricant, the engine should have an oil cooler.

In view of the present state of development of in-line Diesel engines the estimate of 5 pounds per h. p. may be considered by many to be impossible of attainment. However if the present experiment with the radial gasoline engine in combat cars is carried to a successful conclusion, it may be possible to adapt the radial Diesel to Army tanks. Aside from this type, it must be admitted that the engine weight factor prevents the present Diesels from being considered suitable for tank use. Further development may result in reduction in weight to the point where Diesel engines will be satisfactory tank engines and it seems logical and sensible to ask that Government funds be made available for the development of this military requisite as a part of our mechanization program.

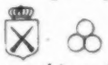
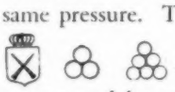
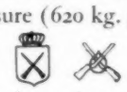
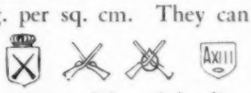
MOTORIZED ARTILLERY OF THE RUSSIAN ARMY DURING A RECENT DEMONSTRATION AT MOSCOW.

Proof Tests and Proof Marks

III: Continental Practices (Continued)

By Calvin Goddard*

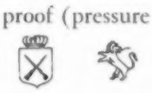
SPAIN.—The establishment of proof houses for the testing of weapons of Spanish manufacture was decreed by a law enacted on January 31, 1915. Eibar, center of the country's arms industry, was properly chosen as the site of one of these while Barcelona claims another. But it would appear that there was considerable delay in placing the project on a working basis, for many Spanish pieces imported into the United States during the years immediately subsequent to 1915, lack the stampings which later appeared on arms arriving from that country.

In substance, the proof regulations obtaining at the Eibar Proof House when I visited it in 1929, were as follows: 1. Single barrelled, muzzle-loading shotguns undergo a single (definitive) test with black powder at 900 kg. pressure per sq. cm. and receive the following proof stampings:  2. Double barrelled muzzle-loading shotguns are subjected to two tests, provisional and definitive (both with black powder) at the same pressure. The marks used to indicate acceptance are:  3. Single barrelled, breech-loading shotguns are tested but once (with black powder) and at a lower pressure (620 kg. per sq. cm.). They are then stamped as follows:  4. Breech-loading shotguns of two or more barrels receive a provisional (black powder) proof at 900 kg. per sq. cm. and a definitive proof (black powder also) at 620 per sq. cm. being stamped thus: 5. Breech loading shotguns of two or more barrels designed for smokeless powder receive three proofs, the first two with black powder, under the same conditions as outlined for item 4 above, and the third with smokeless at a pressure of 850 kg. per sq. cm. They can then receive the following marks: 

6. When a *special* smokeless proof is requested, breech-loading shotguns receive four tests, i. e. provisional, definitive, and supplementary (as outlined in item 5) and a *sur*-supplementary, in which "Diamond" smokeless powder is employed at a pressure of 900 kg. per sq. cm. In this case the stampings are:

For single-barrelled arms For double-barrelled arms

7. Rifled shoulder weapons are proved provisionally with black powder charges developing 900 kg. per sq. cm. and definitively with a metallic cartridge so loaded as to develop pressures 30 per cent in excess of standard commercial loads. Stampings are

8. Rifled carbines (short shoulder arms) receive a single proof at pressures 30 per cent in excess of the commercial, and are marked: 9. Revolvers receive a like proof (pressure 30 per cent above standard) being stamped:  10. Automatic pistols are similarly treated, and bear the same markings:

Certificates are issued to indicate that the arm described has passed the usual proof tests.

In December, 1929, a royal decree established a new set of official stampings pictured below. It will be evident that some of these are identical with those just shown, while others are variants of these, and still others are newly added. 1. Mark of acceptance for all arms: Eibar Barcelona 2. Definitive proof mark for smooth-bored muzzle-loading arms of one or more barrels, assembled: 3. Provisional proof mark for breech-loading, smooth-bored arms and smooth-bored automatic arms: 4. Definitive proof mark for the above arms: 5. Mark for the single definitive proof applied to rifled carbines and muskets, whether automatic or not: 6. Mark for the single definitive proof of low powered target pistols and carbines: 7. Mark for the single definitive proof of non-automatic pistols: 8. Mark for the definitive proof of revolvers:

9. Mark for the definitive proof of automatic pistols:

10. Mark indicating, for all arms, that they meet the required tolerances:

11. Mark for the supplementary proof of breech-loading shotguns and automatic shotguns:

12. Mark for the second supplementary proof of breech-loading shotguns and automatic shotguns:

13. Mark employed for definitive proof of foreign-made arms:

Some of the above have been declared obsolete by the present Spanish Republican Government, and replaced by the following: 1. The official Eibar acceptance mark is now while the official Barcelona mark of acceptance is Nos. 2 to 6. No change; 7. This mark is now Nos. 8 and 9. No change; 10. This has been changed to

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Table of Obligatory Tests and of Proof Marks Employed by
The National Small Arms Testing Bureau of Italy

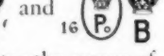
TEST			Proof Pressures in Kilograms per Square Centimeter	MARKS USED		NOTES
No.	Cal.	Objects Tested		Facsimile	Location	
				Identifying mark. Crest of the district in which the bureau is located, surmounted by the royal crown. Brescia: Gardone: o		To be placed on all arms and barrels passing the tests.
1	A	Powder—Black or smokeless. Barrels—Unassembled.				Pressures, proof marks, and number of test shots to be the same as for completed arms of corresponding types.
2 3	B C	Powder—Black. Guns—Muzzle-loading. a. Finished in the white. b. Finished completely.	620		barrel, lock and frame	
4 5	D E	Powder—Smokeless. Guns—Smooth-bore, breech-loading. a. Finished in the white b. Finished completely.	900* for 16 gauge or larger 1000* for gauges smaller than 16		barrel and action	This test calls for 2 shots per barrel. The pressure of the 1st test shot is such as to insure, for the resistance of the barrel at about 16 cm. forward of the breech, a margin of safety equal to or greater than that fixed for the breech when tested at 900 to 1000 kilograms per square centimeter.
6	F	Powder—Black or smokeless. Arms—Rifled.	To exceed by 30-50% the pressure developed by the most powerful cartridge in general use and not deemed dangerous.		Barrel, lock, slide, and cylinder	Weapons to be subjected to this test must be completely finished. In the case of short arms, the test pressure is indicated on the record card delivered with each one proved.
7	G	Powder—Black or smokeless. Arms—Sporting pistols.				Pressures and proof marks identical with those for sporting guns, but one shot only per barrel.
8	H	Powder—Black. Weapons—Small cannon.	That of the normal charge increased by 30%		Barrel and lock.	Weapons to be in completely finished state before being tested.

*For guns with chambers not longer than 70-mm. When longer, pressures are increased proportionately.

11. This is at present Nos. 12 and 13. No change.

Still other Spanish proof marks are found listed in the "Rules and Regulations of the Leigé Proof House," published in 1924, which shows cuts of the stampings used in several different countries. One which we have not already described and illustrated, is the: mark placed on *rifled* muzzle-loading guns after their single definitive proof

Additional Spanish proof marks which we have not described are: 1. That used for the single definitive proof of breech-loading shotguns , and 2. That stamped on arms which have undergone a special proof with an excessive overcharge **E**

Major H. B. C. Pollard, in his "Book of the Pistol," shows two other Eibar proof marks, which evidently antedate any that I have illustrated. They are and  In the latter, the figure 16 presumably indicates the gauge of the gun so marked.

ITALIAN PROOF HOUSES.

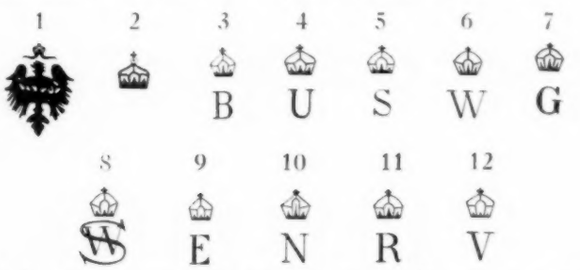
SHOT GUNS

Provisional Proof of barrels	Definitive Proof with Black Powder		Definitive Proofs with Smokeless Powder	
	Of the arm finished in the white.	Of the arm completely finished.	Of the arm finished in the white.	Of the arm completely finished.
	PN	PN FINITO	PSF	PSF FINITO

RIFLED ARMS
(Rifles, Pistols, Etc.)

ITALY.—Here again we find two proof houses, one at Brescia and one at Gardone. Each, as usual, has its individual stampings. These are illustrated and described in the table on page 294 and show stampings current in 1929. These differ in some respects from those printed in the 1924 edition of Belgian Proof Rules, which are shown in the table above.

GERMANY.—In Germany we find twelve basic proof stampings now current. These are reproduced below and numbered in sequence. They are applied as follows:



(A) Smooth-bored, muzzle-loading shoulder arms carry stamps 1, 1 plus 4, and 5, on barrel, and 1 plus 4 on breech, or 3 and 4 on both barrel and breech. (B) Smooth-bored, breech-loading shoulder arms, bear the marks, 1, 1 plus 4, and 5 on barrels, if cylinder bored. If choked, these are stamped 1, 1 plus 4, and 6. In either case, the action will show stampings 1 plus 4. (B-1) Barrels of choke-bored, breech-loading shotguns, which are rifled in their choked portions, are stamped with 1, 1 plus 4, 6 and 8, the action being marked as in the preceding case (with 1 plus 4). (C) In some instances, smooth-bored shoulder weapons (excepting choked arms) and carbines may bear stamps 3 and 4 only on the barrel, and the same on breech or action. Under similar conditions, military carbines, such as the Mauser 1888, may show only marks 2 and 10 upon the barrel as well as upon the receiver. (D) Revolvers carry stampings 2 and 4 upon barrel, cylinder, and frame. (E) Repeating and target pistols show marks 2 and 4 on barrel and frame. (F) Arms once proved and stamped, which later undergo some modification necessitating their reproving, will exhibit, after such reproof, marks 11 and 3 on the barrel, breech, or action, in addition to those which it received when first proved. (G) Following the passage of the German proof regulations of 1891, arms then already completed and ready for sale were allowed to be sold without molestation if imprinted with the stamping No. 12 on barrel and breech or action.

Approaching the subject from another angle, the various German proof marks have the following significance: No. 1—This is placed upon barrels which have passed the first (provisional) proof. No. 1 plus No. 4—This combination appears on barrels and actions to indicate that they have passed the second (definitive) test. No. 2—This stamp is found on pistols and revolvers which have passed the single proof required of such arms. No. 3—This shows on such rifles and shotguns as undergo but a single proof test. No. 4—This does not appear to be used save in conjunction with stamping No. 1 (*vide supra*). No. 5—This is imprinted on smooth-bored (shotgun) barrels. No. 6—This appears on choke-bored (shotgun) barrels. No. 7—This is used upon rifled shoulder arms. No. 8—This is practically a combination of 5 and 6, and shows on choke-bored shotguns the choked sections of which are rifled. No. 9—This is reserved for "express" rifles. No. 10—This stamping, or the word "NITRO" in its place, indicates that the arm has been tested with smokeless powder. No. 11—This appears on arms reproved after modification. No. 12—This was used on arms already completed, but unsold, after passage of the proof laws of 1891.

In addition to these twelve stampings, we find others, paralleling closely those used in England, and for the most part self-explanatory. Thus: "St. M. G."—means adapted for *Stahlmantelgeschoss* (i. e. steel-jacketed bullets). And in Germany, steel-jacketed *means* steel jacketed, although of late years gilding metal has begun to replace steel as a jacket material in that country. Again, "K. M. G." indicates *Kupfermantelgeschoss* or a barrel designed for copper-jacketed missiles, while "B. L. G." stands for *Bleigeschoss,* or one intended for lead bullets only. Shotgun barrel calibers or gauges are stamped upon them in figures as for instance "24" indicating 24 gauge. Chamber calibers are designated by numbers surrounded by a circle as: the number 12 in a circle indicates 12 gauge. In rifles, caliber number appears in figures, thus "99.70," while caliber plus shell length (a common German usage) is shown thus $\frac{9.3\text{-mm}}{82}$. Here the "9.3-mm." indicates the diameter of the bullet, and the figure "82" indicates under this usage the length of the shell in millimeters.

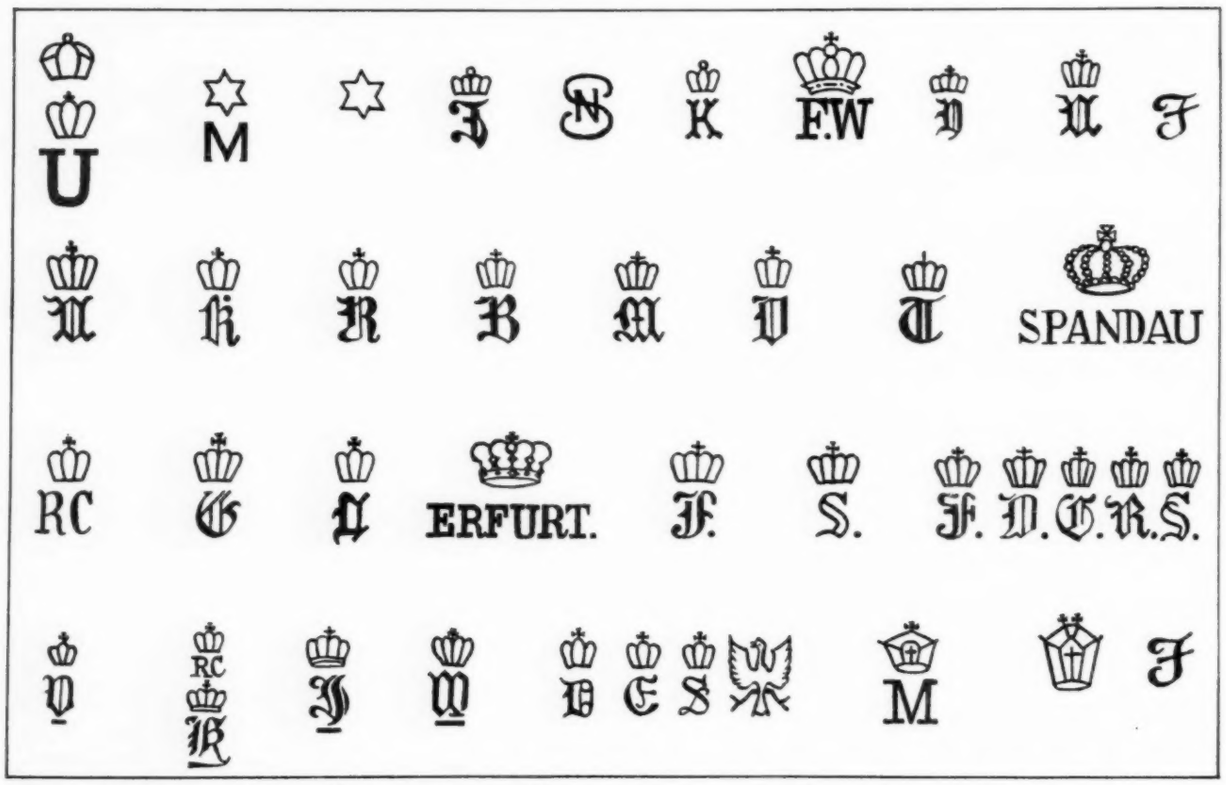


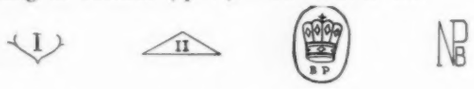
Plate II: Proof and Other Marks on German Military Arms from the Franco-Prussian War to the Present.

Plate II illustrates an assortment of proof and other stampings found on German military arms dating from the Franco-Prussian War to the present time.

Austria.—Like France and England, Austria has two proof houses, one at Vienna (spelled "Wien" in German) and one at Ferlach. Their proof marks, and the conditions under which they are applied, are as follows:

	Vienna	*Ferlach*
Following the first proof on single barrelled shotguns		
Following the second proof on double barrelled shotguns		
Following the third proof on multi-barrelled guns, the second proof on single barrelled arms, and the one and only proof on revolvers, pistols, and small-bore weapons		
Following proof with smokeless powder		

Hungary.—The single Hungarian proof house at Budapest, employs, like the Austrian houses, four sets of stampings, conditions precedent to which are identical with those obtaining in Austria (q. v.). The marks are:



Czechoslovakia.—Prior to the passage of the law of December 17, 1931, the two Czechoslovakian proof houses at Prague ("Praha" in Czechoslovakian) and Weipert ("Vyprty") used the markings shown below, based on exactly the same tests as previously described for Austria (q. v.) and Hungary. Indeed, the great similarity between the stampings imprinted after the smokeless powder proof at all five houses (Vienna, Ferlach, Budapest, Prague, and Weipert) would indicate the probability that, prior to the breaking up of Austria-Hungary at the close of the World War, there existed, as might be expected, a close relationship between all of these organizations. The marks follow:

Prague: .....

Weipert: .....

(Mahrholdt shows different stampings for the 3d (definitive) proof at both Prague and Weipert, thus —Prague and —Weipert.)

It would appear that the law referred to (that of December 17, 1931) established a single set of proof marks to be employed both at Prague and Weipert. These are:

1. This is the stamping placed upon shotgun barrels rough bored and not assembled, following (voluntary) provisional proof.

2. This appears on completed and assembled shotgun barrels after their (obligatory) provisional proof.

3. This is found on shotguns which have passed the (obligatory) definitive proof with black powder.

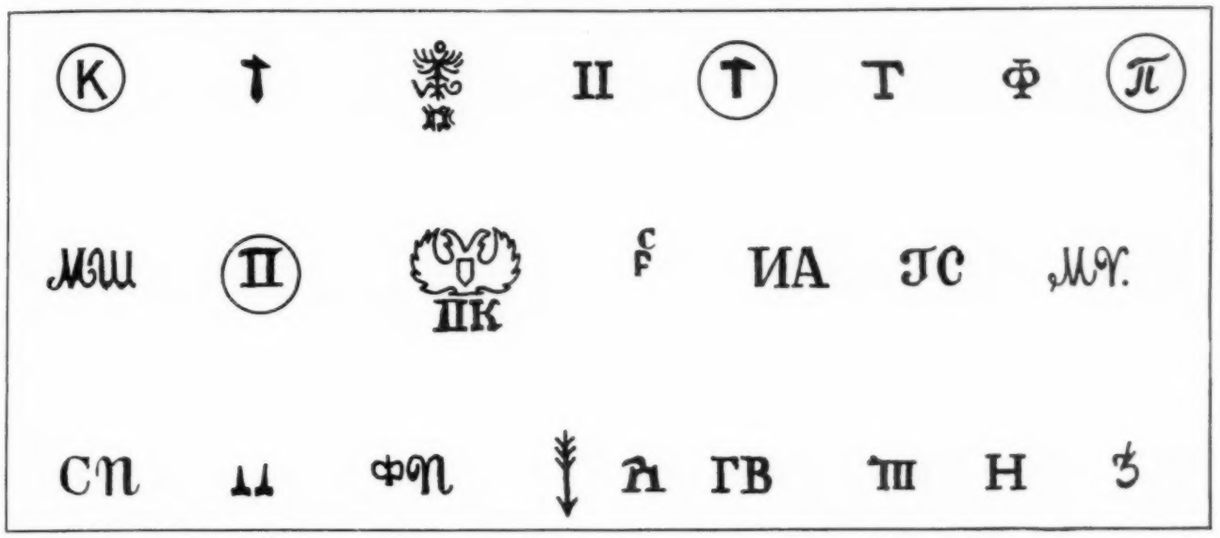


PLATE III: RUSSIAN MARKS ON A NAGANT REVOLVER AND A RUSSIAN MILITARY RIFLE.

4. This is stamped following the obligatory test with smokeless powder on completed shotguns.

5. This shows on rifled arms proved definitively with smokeless powder. (Those designed for use with black powder exclusively, and passing a definitive proof test with this, receive stamping No. 3.)

Small-bore weapons for rim-fire ammunition receive, when proved, stamping No. 3. Revolvers are also marked with stamping No. 3 after proof with black powder, or with No. 5 if proved with smokeless powder. All automatic pistols receive stamping No. 5.

An interesting discussion of proof tests as they exist in the several countries employing them appears in Richard Mahrholdt's *Handbuch für Waffenfreunde,* published at Innsbruck, Austria, in 1931. From it I quote the following:

OFFICIAL proofs.—"In all civilized" (take note, United States!—C. G.) "countries there exist laws which require arms makers to submit their products, before offering them for sale, to an official testing station to be 'proved.' Following the proof tests, those parts which are of first importance from the standpoint of strength, such as barrel and breech, receive stampings which indicate that they have successfully passed the requirements prescribed.

"Arms, or parts of arms, which have failed to pass, are segregated, or rendered unsuitable for further use.

"If the maker desires no further test, the proof of shotguns and weapons designed for lead bullets only is conducted with black powder alone. In Austria, a load is employed for the first (black powder) proof which exceeds in the pressure, which it develops on firing, that of the ordinary commercial loads by one hundred per cent in the first test, by 66 per cent in the second, and by 33 per cent in the third.

"The first and second tests are applied only to barrels. These are fitted with a special breech screw prescribed for such tests, and loaded from the muzzle. In 16-gauge guns, the first proof is carried out with 9.6 grams of powder and a lead cylinder weighing 57.6 grams; the second with 8 grams of powder and a 48 gram lead cylinder. Such tests will result at the very beginning in the segregation of faulty barrel materials for further attention. For the third test, at which time the barrel is completely bored, and breeched, there are used, for a 16-gauge arm, 6.4 grams of powder and 38.4 of shot.

"As a testing powder, Austria uses the extra fine sporting and target powder known as "No. 1." In Germany, similar arms undergo but two tests, these are more severe, however, than the Austrian. Thus the first German test is with three times the normal powder loading and double the normal shot charge. The second (carried out on guns completed and ready for use), involves a double powder charge and one and one-third the normal shot charge. Likewise in the case of rifles, the first test is with three times the usual powder load and a bullet of one and one-third times the normal weight, and the second with a double powder load and a bullet the same weight (one and one-third normal).

"Smokeless powder proofs of shotguns, and of rifles designed for lead bullets are conducted only on special request. The Austrian practice in this case (and the German as well) is to employ an especially powerful test powder with the regular bullet or shot charge ahead of it. Barrels designed for firing jacketed bullets are regularly proved with smokeless powder, without the need for any special request to that effect. The Austrian regulations require that the standard cartridge case (for the caliber tested) be completely filled with No. 3 smokeless powder, the regular commercial bullet to be placed ahead of this. This test is practically without significance, however, since the load employed barely exceeds the standard commercial charge.

"We must bear in mind the fact that the presence of proof marks is no assurance of the origin of a weapon. For example, weapons rough-finished in Austria, and completed and tested in Germany, will bear the regular German proof marks, and vice versa. Also, to the damage of the purchaser, certain arms are sold at fancy prices as 'genuine English,' which as a matter of fact were produced somewhere else at a low cost, but sent to England for proving, and stamped in addition with the name of some English firm which may actually be non-existent.

RUSSIA.—I have been unable to locate any data on the proving of arms in Russia. Lacking this, drawings were prepared of markings present on a Russian Nagant revolver, and a Russian military rifle. These appear in Plate III.

(*To be continued in the May-June issue of this Journal.*)

ARMY ORDNANCE

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Month by Month

"Can We Limit War?" is the title of a remarkable book which has just come from the pen of Hoffman Nickerson—the closest approach we have in these United States to England's Belloc. It is remarkable in many respects. First of all, Nickerson has good sense—a quality of authorship too often conspicuous by its absence in the flood of current writings on war and peace that has been deluging the stalls and the reading clubs these many years now. Most of these are mere eyewash: their authors rant and rave that war can be no more, as though the twentieth century model of humanity was forever purged of its every vice and ailment in 1914-1918, that since the World War our planet has been populated by a race more closely resembling angels than men, that distinctions of race and creed and color have been merged in the fierce aftermath of the war, that differences of class, station, political economy and even of civilization are forever gone, that the will to live with stomachs at least half filled and tastes for comfort and happiness at least half gratified have, in this new humanity, been kicked overboard. Not so with Nickerson; he is a realist with a decent respect for experience and a matter-of-fact belief in the lessons history teaches. Because he is a military historian and commentator he is a *rara avis* in the American scene—a distinction to be granted to others of our fellow citizens only after an inquirer here in the United States has, like Diogenes, taken his lamp in hand and engaged in the search. The count after such a search could be enumerated on the fingers of one hand and Nickerson would be the thumb or little finger depending on where one began the tabulation.

Can We Limit War?

Here in the United States we have no Liddell Hart, no Belloc, no Fuller. When we find anything like them it is cause for acclaim. This is the reason why Army Ordnance for some years past has considered itself fortunate to be able to join with many of the leading journals of the world in presenting some of the Nickersonian texts to its readers. (Of the chapters in "Can We Limit War"—published February, 1934, by Frederick A. Stokes Company, $2.75—some four or five of them have appeared as articles in these pages.) For the same reason our readers and others have detected in the author's previous writings the research, energy and ability which connote the real historian and analyst. Readers of Nickerson's "Inquisition," his "Turning Point of the American Revolution," and his "Warfare" (with Spaulding and Wright)—realize that he is a military historian and philosopher of first rank. His talent and industry in a field where the nominees for honors are all too few make the appearance of his latest work and this comment upon it entirely fitting.

But there are additional reasons for hailing "Can We Limit War?" One of these we have already intimated in the earlier reference to eyewash. Our press, our books, our radio, our round-tables at our institutes, our forums for the discussion of war and peace, have been getting crazier and crazier with each new moon. Many of our public men—and we say it without reference to partisan politics at all—had until last March made perfect simpletons of themselves. Some of them are still at it. They dish out a lot of buncombe that made them and the people whom they allegedly represent laughing stocks at home and abroad—especially abroad. They have the unhappy faculty of bobbing up on every occasion with some unusually childish cure for the world's ills. They see red every time such words as "military," "naval," "armament," "neutrality," are uttered, for these they substitute in their litany of pious aphorisms such phrases as "outlawry of war," "cancellation of debts," "pacts of non-aggression," "aggressive weapons," "economic embargoes" and many more, all the time taking an occasional fling at anything like the sanction of authority sustained by force. But the debunking process is coming at last and circumstance has brought it about. In the realm of action our own Army and Navy are not being treated like Missouri houn' dogs any longer; in the realm of the written and spoken word folks like Nickerson are leading the debunking procession. Of the former we all know pretty well of the change in attitude toward our defense services and we believe the great rank and file of our people are soundly behind the present policy of providing a treaty Navy and a modernized, well trained, well equipped Army. Of the latter it is the purpose of this comment to delineate the thesis of "Can We Limit War" and thus show that by its sanity and plain-spoken deduction it is a harbinger of what we hope will be a world wide return to common sense on the greatest of international questions: war and peace.

The thesis of this book, to quote the author, is "that war, the use of organized force between human groups is inevitable because men are imperfect, because any social order demands armed police power, finally because an individual or group determined to attack another can be restrained only by superior force. It cannot be intelligently considered apart from peace, for the quarrels, competitions and rivalries of peace are its source and a better peace is its object; both peace and war are only forms of political intercourse between groups. Although force can never be abolished, on the other hand war has always been limited morally, politically, economically and technically, so that when military writers speak of 'unlimited war' they are merely using a shorthand phrase for its imperfectly limited forms. The degree of limitation has risen and fallen throughout long cycles of time; a civilization full of discontent will have a high potential of conflict, one which enjoys moral unity will have a low potential. The

amount of actual war will depend upon the potential plus the time and effort required to achieve a true decision either by reconciliation of the defeated group or by its destruction either actual or political. An age afflicted like our own suffers chiefly from ideals which divide men instead of reconciling them, second from incompetent military methods; happily other ideals and methods are beginning to appear and upon them depends the hope for limiting war. If we can establish a true moral unity backed by effective police forces we shall succeed, if we cannot do so we shall fail—leaving the problem to the diminishing remnant of our descendants."

It may be that "Can We Limit War" is in some respects a bit ahead of its time in that as applied to our own national defense it denies the need for an army of the size contemplated by the National Defense Act of 1920 and that it envisions a nucleus of regulars which would not require anything like the military strength which the Act contemplates. The many pages of historical analysis disprove the wisdom of the huge mass of the Napoleonic armies as applicable to conditions of the future. Certainly it was seldom the military object of the Roman Empire, the middle ages or the 18th century to effect the complete overthrow of a hostile country. But the conscript army is "the typical military product and instrument of democracy." It would seem in this respect that the change must come in democracies first and in armies later on. In the light of current happenings it looks like the change in democracies is under way; the ultimate result, however, remains to be seen. At the present stage of things we differ from the author's opinion as to the obsolescence of our National Defense Act. We prefer to believe that the sounder view is that expressed by General MacArthur that the complexion of an army is slow to change but that modern developments "point to the probability that any major war of the reasonably proximate future will see a swing away from the tremendous and ponderous combat forces that have characterized campaigns of the past seventy-five years and that in their place will appear relatively mobile, highly trained, and very powerful, though somewhat smaller, formations."

And the answer to the one big question proposed, "Can We Limit War" is likewise the answer to the question, "What is the real hope for peace?" The real and only hope lies in a common moral unity. Whether one agrees or not with the particular moral media as Nickerson analyses them there can be no disagreement as to the one general means by which peace really can be hoped for. That's the answer and there are no two ways about it. Nickerson puts his discerning probe directly on the sore spot. Now watch the alleged moralists squirm. But military moralists will not.

Were unlimited facilities at our command we would put this book in the hands of every student of defense. Were they limited in any respect, we would at least make certain that every one of several important groups in our own country had it drilled into them if it required a refresher course on a catachetical basis to do it or, for some of the harder heads, the pillory. We would assemble first some of our past Secretaries of State and their supernumeraries and any future candidates for that high office. Next we would corral a great many of the university professors—and a couple of university presidents—all the officials of associations meddling in foreign policies, all the moneyed peace propaganda agencies and all the peace societies—masculine, feminine and mixed—and demand that they refute the Nickerson thesis article by article. Not being able to accomplish either of these objectives for want of the wherewith, we would suggest that those of us who have not lost our heads completely on the subject of war and peace counteract the eyewash wherever it is compounded with the clear, convincing and concrete analysis of this writing. It is high time that the basic truth of such a momentous question be adhered to by our own people while it is yet a subject of peaceable discussion. The way things are going it would be presumptuous to prophesy how long the present favorable condition may exist.

ON pages 268 and following in this issue of ARMY ORDNANCE we have reproduced some of the architects' studies of the new Aberdeen Proving Ground. These are the first pictures of the new Aberdeen to appear. They give a good indication of a style and type of construction characterized by sturdiness and simplicity.

GLIMPSES OF THE NEW ABERDEEN

We take this opportunity to congratulate the very efficient personnel of the Construction Division of the Office of the Quartermaster General of the Army through whose courtesy these studies are reproduced. In the short time which has intervened since the allotment of funds for the new Aberdeen, the architects of the Construction Division, coöperating with the authorities of the Proving Ground, have been working at top speed. As the designs show, neither beauty nor utility have suffered; time, being an important consideration, has not been wasted in these preliminary stages.

So in giving the first indication of what the new Aberdeen will be like, we bespeak thanks for Ordnance to those very efficient architects and draftsmen of the Construction Division whose ability to visualize the completed project makes one's desire to see the finished job all the more intense.

THE recurrence of the demand that the Government keep out of competition with private enterprise throws additional light on one of the big points of the attack now being waged on the production of munitions in the United States. Certain groups are bent upon having all munitions at all times produced exclusively in Government arsenals; this as a means of control to prohibit exportation abroad. On the other hand industry is again demanding that Government operate not so much as a peanut stand if a citizen or group of citizens is prepared to do the roasting and marketing as economically and as efficiently. This latest demand comes from several united organizations of New York including the Economic Council, the Merchants Association, the Chamber of Commerce, the Board of Trade and the Citizens Budget Commission. In their program presented to Governor Lehman recently, the following plank was included: "Neither the State nor any local government within the State should introduce any additional business activities in competition with private enterprise. It should be made absolutely clear by Government that the further invasion of private business activity has been brought to a definite and permanent halt."

MUNITIONS MONOPOLY

This is an echo of the stand taken last year when the Shannon Committee of the House of Representatives investigating Government in business disclosed the very startling growth of state trespassing upon individual prerogative.

Following the Shannon Committee's report not much was done in view of the serious domestic economic condition at the time. Whether anything ever will come of it remains to be seen. Meantime it should be put down as a matter of accepted policy that even in the munitions field we cannot hope nor should we want to have sufficient capacity in Government establishments for war requirements. Here is where the whole theory of our present defense program finds its real application. It is bad policy all around to have the Government producing a commodity which private industry can produce just as well and just as economically. In the long run private industry will have to do the producing in emergency anyway but if Government is going to produce everything it uses in time of peace not only will it fail in trying to have private industry help out in time of war but it will find very probably that there is no private industry to turn to. Here again comes in the question of our Government arsenals. So long as they are experimental and training stations they are among the most important of Governmental activities. So long as they are used as a check on production costs they are performing an essential function. But who in his senses would want to see the taxpayers' money invested in plants and arsenals of sufficient capacity to make all the munitions in time of war? The original Muscle Shoals development and its costs would not be a drop in the bucket.

And while we are on the subject a word should be said with regard to a great deal of the publicity which has been making the front pages during the past few weeks concerning the profits of manufacturers of military equipment. In some cases testimony showed that profits were not inordinate at all. In others it was made to appear that as much as 30 per cent was not unusual for some military items. We have our doubts that the bases for such figures are at all times reliable. Certainly a concern which has expended untold amounts of its own money for the development of a particular appliance having a military use is entitled to a fair return on its investment. The trouble is that political investigators are at times too anxious to make a case particularly where such loathsome individuals as "war profiteers" are concerned. It is to be hoped that due consideration will be given developmental costs and that private manufacturers will be praised for and encouraged in their initiative rather than be made the scapegoats of official investigators whose prime concern is certainly not engineering development and advancement. Manufacturers of appliances used by the defense services are entitled to a fair deal. If there are any gougers among them they should be given no quarter. The rank and file are honest, desire to serve, and ask only a fair recompense. These should be encouraged and helped in every legitimate and practicable way. They are a country's salvation in time of war.

Military Propagandists

THE 100th anniversary of the birth of Alfred Nobel, inventor of dynamite and founder of the Nobel awards for international peace, was celebrated last December with fitting ceremonies throughout the world. Probably none of the celebrations was more appropriate than that held in New York City, because it boasted the presence of former Secretary of State, Mr. Frank B. Kellogg, Nobel peace prize winner in 1929; Dr. Albert Einstein, Nobel medalist in physics, 1921; Mr. Sinclair Lewis, who won the prize in literature in 1930; Dr. Irving Langmuir of the General Electric Company, winner in chemistry for 1932. The meeting was under the sponsorship of World Peaceways.

Honor to Alfred Nobel is never misplaced, simply because the inventor of dynamite has contributed greatly to the happiness and material progress of mankind. The Nobel prizes are commendable as much for the contributions to science and the arts they have nurtured as for the development of understanding among peoples. Certainly it would be the role only of a maudlin mind to raise one word of unfavorable criticism of the donor's memory for any intention he may have had and any means he actually made available for assuring international peace by providing a prize for the person "who shall have most or best promoted the fraternity of nations and the abolition or diminution of standing armies and the formation and increase of peace congresses."

On this occasion, the former Secretary of State asked a question of his listeners which, so far as we have seen, was not answered. Not being open to the charge of "military propaganda," these pages may not be the proper place for the reply. The question was, "Do you know of anybody who wants another war unless it be military propagandists?" Just for the mental gymnastics of the thing let's see what the question implies and, while we are about it, let's attempt an answer even to so distinguished a questioner as a former Secretary of State. If the questioner had posed his question this way, "Do you know of anybody who wants another war" the incident would not be worth talking or writing about. If the co-author of the Kellogg Briand Pact were to take his stand at the geographical center of the United States and interrogate the 125,000,000 who constitute the citizenry, he knows, we know, they all know that the answer would be a unanimous "no." If there were a few scattered dissenters it would be because while some of the keepers were standing in line to record their negative answers one or two insane inmates, having no one to keep them in their padded cells, had broken out and gotten into the long line of responders too. No one in his right mind would even bother to go to the crossroads to record his vote or even bother to do it by mail, if permissible, because the result beforehand would be cheerfully acknowledged by every single citizen of the United States to be an unqualified, unanimous, absolute "no."

But the Secretary did not stop his question at that point; he added "unless it be military propagandists." That added phrase causes the trouble. It is architecturally of the same design as all the peace talk; it assumes, as pacifists always assume, that the words "military" and "war" are the same. And they most decidedly are not. If the questioner had asked—but he didn't—"Do you know anybody who wants war unless it be *war* propagandists?" the cross-roads result would record another unanimous "no." But that would call for another question in fairness to the voters: "Do you know of any war propagandists in the United States?" And there is where the division would come. A great many people in our country make the same mistake the former Secretary has made. They take "military" and "war" as synonymous. That is the unfairness and the injustice and the insidiousness of the thing. We'd like the distinguished ex-Secretary to make that clear whenever he addresses World Peaceways again or whenever he speaks on the subject anywhere. And while making the correction the ex-Secretary might take the trouble to impress his hearers that, in the United States we have no war propagandists, that we have any number of military, semi-

military and national defense organizations all of which are for national defense in one form or another and that all of them are pacifistic in the sense that they do not want war—only they feel, based on experience, that the best way to keep the peace is to be ready for its breach. Insofar as the organization which sponsors this Journal is one of these societies, and the only one devoted exclusively to American munitions, we can vouch to the ex-Secretary that we are far more peaceably inclined than World Peaceways and similar much publicized groups. Our pacifistic fellow citizens are trying to convince the American people that as a people they are warlike and that they must be reformed. We deny that there is this warlike spirit. Somehow or other for all the talk there seem to be just a few spots on the map of the world where any war-mindedness really exists. However that may be, it would be well to quote, for instance, Cicely Hamilton who says, "It isn't the guns that start the fighting but the people who fire them"; or Lord Raglan's "Disarmament . . . . is a quack remedy for the disease of war. Disarmament will come when war-mindedness has disappeared and not before."

HAIL TO THE TOP SERGEANT!

WE are indebted to Col. John R. Brewer, commanding officer of Fort George G. Meade, for furnishing the data given below and, more especially, for the thrill that comes from reading and thinking about them. They relate to one of those common places going on almost every day in the Army—the retirement of a top sergeant. In this case the non-commissioned officer was Master Sergeant John Schmid, Ordnance Department, who completed thirty years of faithful service to the Army and retired January 31, 1934. Here is the record which is its own commentary.

Sergeant Schmid was born in Wilkes-Barre, Pennsylvania, in 1883. In December, 1905, he enlisted for Company C, 23rd Infantry. His service and record thereafter are as follows: Company C, 23rd Infantry from Dec. 27, 1905 to Jan. 5, 1908; discharged as private; character: *excellent*. Company C, 23rd Infantry from Jan. 6, 1908 to Jan. 5, 1911; discharged as private; character: *very good*. U. S. Marine Corps from Jan. 11, 1911 to Jan. 10, 1915; discharged as private; character: *good*. Ordnance Department from Feb. 1, 1915 to Sept. 23, 1919; discharged as private; character: *excellent*. Ordnance Department from Sept. 24, 1919 to Sept. 23, 1920; discharged as sergeant; character: *excellent*. Ordnance Department from Sept. 24, 1920 to Sept. 23, 1923; discharged as sergeant; character: *excellent*. Ordnance Department from Sept. 24, 1923 to Sept. 23, 1926; discharged as sergeant; character: *excellent*. Ordnance Department from Sept. 24, 1926 to Sept. 23, 1929; discharged as staff sergeant; character: *excellent*. Ordnance Department from Sept. 24, 1929 to Sept. 23, 1932; discharged as technical sergeant; character: *excellent*. Enlisted for three years in the 30th Ordnance Company (Heavy Maintenance) Sept. 24, 1932, as a technical sergeant. He was retired January 31, 1934, in the grade of master sergeant.

During the World War this soldier served in the Regimental Machine Gun Company of the 28th U. S. Infantry, First Division. As a member of this organization he participated in the following offensive drives: Montdidier-Noyon sector, Aisne-Marne sector, St. Mihiel sector, Meuse-Argonne sector. He also served in the Lunneville defensive sector.

Sergeant Schmid was awarded the Victory Medal for World War Service on which five bars are attached, one for each of the above named battles.

This man wears four gold chevrons on his left coat sleeve indicating more than two years of service over seas during the World War. On his right sleeve appear two gold wound chevrons. He was wounded July 21, 1918, in the Soissons drive, and he was wounded a second time October 7, 1918, in the Meuse-Argonne.

In the Soissons drive Sergeant Schmid went over the top with his organization (Machine Gun Company, 28th Infantry) and was waiting behind some brush for the zero hour, at which time the advance would begin. Just as he started forward he was hit in the knee by an enemy bullet. In the Argonne, he had been relieved from duty on the front line and had gone to the rear with reserves when he was struck by a fragment of an enemy high explosive shell.

Why single out one who is typical of thousands of the noncoms and enlisted men of the Army? The answer: No particular reason except to sing the praises of one who represents the backbone of any military organization—those unsung heroes who carry on the glorious tradition of faithful and constant service. Reënlistments one after another, promotions richly deserved, service chevrons, wound chevrons—they are all in the day's work. But—*character: excellent!* There is the very sinew of service. Before Sergeant Schmid and all his fellows like him, we stand in wordless tribute and admiration. A world that has forgotten the meaning of authority, discipline, loyalty and devotion to duty can look to the Army top sergeant with "character—excellent."

HABER PROCESSES

WORD of the death of Fritz Haber at Basel, Switzerland, on February 1st at the age of 65 recalls the work of a chemical engineer who devoted a great deal of his time and energy to the progress of national defense. The process for the fixation of nitrogen by the synthesis of ammonia, which came to be known as the Haber process, was used in a modified form in Nitrate Plant No. 1 at Muscle Shoals, construction of which was begun in October, 1917. Compared with other processes then known, it offered economy of operation and comparatively small power consumption which the other methods lacked. That it was not successful in this enterprise was because knowledge and experience needed for the operation of the process were lacking in this country. Due to the uncertainties of Plant No. 1, United States Nitrate Plant No. 2, also at Muscle Shoals, utilizing the cyanamid process came into being. Here was a case where experiences in operation and knowledge of technique as well as increasing requirements made necessary a change in major plans.

Fritz Haber's career had considerable romance in it. It was not confined alone to the wide scale of his studies of chemical processes. While his inventions included the Haber interthermometer and Haber firedamp tube, both used widely in the study of the mechanics of gases, he returned to the headlines in 1923 in a romantic way. He determined to replenish Germany's diminishing gold reserves by extracting the precious metal from seawater. His floating laboratory, however, proved the undertaking and the idea not worth the effort. There is romance and pathos in the last years of the life of this distinguished scienist—an unwilling exile from his life work.

Laugh, Hoodlums, Laugh!

An Editorial

THE bill, introduced in the United States Senate on January 11th by Senator Copeland of New York, for the control of firearms plays straight into the hands of hoodlums. All firearms legislation, of course, is intended to make the possession of weapons so difficult that the criminal will be stopped in his tracks. That's what the Copeland bill will try to do. But will it? Not in a thousand years. Instead of halting the hoodlum, such a bill as this will give him free reign. It will give the advantage to the criminal element of our population. It will encroach on the responsibilities of the law-abiding citizen. It will give the hoodlum every opportunity to bootleg his own and his pal's weapons while honest John Citizen, without a gun, holds the bag.

Most proposed legislation that we have analyzed from time to time has had some merit in it despite apparent difficulties. We cannot say that much for Senate Bill No. 2258 (the Copeland Bill). As far as we have been able to discover there are so many absolutely absurd provisions in the Copeland bill that we are at a loss to understand how in the world anyone could sponsor such a law. True enough, the sponsors of the bill announce that it is not intended to inconvenience sportsmen or to challenge the constitutional right of the individual to keep and bear arms. But the bill itself sounds like just that very thing is intended. Here are some of the provisions of the bill: Only a manufacturer licensed by the Secretary of Commerce would be allowed to ship concealable weapons and ammunition in interstate commerce and only licensed dealers or individuals licensed by local police would be allowed to receive such guns and ammunition. All packages containing guns and ammunition must be plainly marked on the outside. The United States would be divided into districts and manufacturers would be required to imprint on the base of bullets code letters to designate the district into which the ammunition is to be shipped. Probably the most absurd provision of the entire bill is the one which would require the manufacturer to fire at least one bullet from each new gun of the types described in the bill and to label and file this bullet so that if the gun were ever used in the commission of a crime the police could trace its ownership. Such provisions as these strike us as being about the most absurd things national legislation could possibly attempt to provide. They would be bad enough without the recent experiences of the 18th Amendment. It is quite childish for able-bodied men to come along at this stage of the game and propose federal legislation of this sort. The thing is childish in principle. Even if the principle were correct the things this bill tries to do are downright silly. For instance if only licensed manufacturers and licensed dealers are going to be able to ship a rifle, pistol or revolver in interstate commerce, what is John Citizen going to do when he wants to have one repaired by a gunsmith or manufacturer in another state? Why must a package containing a gun or its ammunition be more plainly marked than any other kind of package? Certainly the right of privacy applies just as well to arms and ammunition and these commodities are just as susceptible of being "lifted" while in transit if their identity must be disclosed to the entire world. And who under the sun ever told Senator Copeland that by labeling and filing a sample bullet from each gun when manufactured he could by this means trace the ownership of a weapon used in the commission of a crime? Surely the Senator knows that the markings on a bullet are susceptible of change overnight and the fingerprinting of a weapon at time of manufacture versus its bore markings a year or five years later is somewhat similar to an attempt to identify a bandit, age 45, by means of a family portrait taken when he was a Beau Brummel at the age of six months.

BUT there are even more fundamental objections to legislation of this kind which should be stated regardless of individual inconsistencies like those referred to above. Candidly we do not see how anyone can logically favor any legislation on the part of the Federal Government for the regulation or control of the manufacture and sale of arms and ammunition unless one excepts machine guns. For purposes of peaceful society no one can say anything in favor of the machine gun. It is dangerous to society, it is in fact a weapon which should be kept strictly in the hands of the law-enforcing and military authorities. But there are various classifications of machine guns. The military type shooting rifle cartridges is entirely too unwieldy and of too great bulk to be of any service to the hoodlum. What he needs for his trade is a small, light, easily portable and easily concealed weapon; all that fulfil these requirements shoot pistol cartridges only. In this connection the act drawn by the Conference of State Commissioners on uniform laws contains the very wise provision that the act be applicable to weapons firing pistol cartridges only and that it not apply to those of military type. The Copeland bill draws no distinction—in the matter of definitions it seems purposely to make the whole subject confusing—as to the difference between the military and non-military types of machine guns. And who cares about the military type so far as the commission of crime is concerned? On this score a recognized authority on the subject has said, "I venture to state that if 500 assorted machine guns of military type were piled together and the combined gang populations of New York and Chicago were invited to take their pick and promised safe conduct in their removal that not a single one of these weapons would disappear though the offer be kept open indefinitely."

We question the wisdom of any kind of a Federal law for the supervision of sales and ownership of pistols, revolvers and ammunition. This is distinctly a question which can and should be handled by the individual states each with its separate and distinct problem. Federal intervention in this field is highly undesirable and if embarked upon will deprive the decent citizen of the opportunity to defend himself against the armed intruder. Who can cite any legislation tending to restrict the sale and ownership of small arms which would not entirely defeat its purpose? Take the Sullivan law in New York State for instance. It is the most stringent act of its kind on the statute books anywhere today. Has it accomplished its purpose? No. Are the gangsters in New York State disarmed today? No. Are the decent citizens disarmed? Yes. In Chicago in 1933 of some 50 odd hoodlums killed in attempted felonies over 45 per cent were killed by reputable citizens in the defense of their lives or property. What percentage of hoodlums killed in New York State in 1933 were

shot by reputable citizens? Zero would be pretty nearly correct. The New York hoodlum knows his victim to be unarmed and acts accordingly.

But proponents of Federal legislation may urge that uniformity will correct this condition. Again we ask did a Federal law correct the bootlegging of spiritous liquors? Arms and ammunition are much more necessary to the hoodlum than are liquors to the average person who patronized the bootlegger. Yet John Citizen went to great length to have his rum. Will not the gangster go to much greater lengths to have the essential tools of his trade?

BUT let us present an expert witness whose ability is well known to readers of this Journal. Col. Calvin Goddard in our estimation is one of the best equipped authorities to discuss this subject and we take the liberty of quoting him:

"I do not know what ammunition control is envisioned. But I do know that the sawed-off shotgun is today much more of a menace than the pistol and revolver. Such an arm can be produced with tools available in any home, in nine minutes by the watch. Can you control shotguns and shot gun ammunition? These are used by millions of sportsmen, and restrictions upon their sale and use, in order to keep them from the hands of the negligible percentage who would misuse them, will be bitterly resented. The sale of pistols and revolvers and ammunition for them can be more easily supervised, but what will this accomplish if the shotgun and its shells are not included?

"The reason that pistols and revolvers can be more easily controlled than shotguns, is because not so many persons are interested in using them. Yet among the many millions of revolvers now existing in the United States, some hundreds of thousands belong to sportsmen who derive much pleasure from using them at the target and in shooting small game. It has been estimated by Mr. Karl T. Frederick of New York City, an able attorney who has made an exhaustive investigation of the subject, that possibly two out of every hundred pistols and revolvers available in the United States today are in the hands of persons who are prepared to use them feloniously. While I do not deny that it is possible to disarm the ninety-eight owners who are law-abiding, and thus put them at the mercy of the thug, I insist that all experience shows that you will not disarm the latter, not even begin to disarm him.

"Why are there so few murders in England? Because arms laws are stringent? No. There were fewer murders in that country before the firearms act of 1921 went into effect, than there now are. The reason is that, if a man kills another in England, he hangs by the neck until he is dead. Be he king or commoner, there is but one penalty for murder. Do you think that the toughest type of gangster in New York or Chicago would for an instant consider a killing if he *knew* that the chances were 95 to 1 that all parties to it would hang within three months? Obviously not. If the laws we now have were adequately enforced, a man could carry a pistol in each pocket if he wished, yet he would be mighty careful not to use it save in self defense provided he knew that punishment for its illegal use would be sure and swift.

"It takes a few hours for any man handy with tools to make a weapon capable of firing a death-dealing slug. For this he does not need metallic cartridges. If they are available, O. K.; if not, black powder can be readily made up of ingredients to be had at any drug store, and a paper cap such as is used in a toy pistol will serve to set this off. The decent citizen, in the absence of other weapons, and fearing a penalty for owning one, would not make such a contraption. The crook would—if put to it. He has already done so in our penal institutions. But outside of such an institution, he would never have to depend on such an uncertain arm."

THIS thing of filing a specimen bullet fired from all arms before they are marketed is a collosal joke. It is impossible to sub-classify fired bullets further than to determine the make of arm from which they came and even this is often impossible. Let us assume that in a given case a fatal bullet is classified as a caliber .38 Smith and Wesson Special, fired through a Colt revolver. There are probably half a million Colt revolvers in the United States which will fire this particular cartridge. Let us assume that there are test bullets from each of these half million Colts on file at the Department of Justice in Washington and that the fatal bullet in question is sent to that department to learn which one of these fired it. Of course the fatal bullet would have to be compared one by one with every test bullet on file until the right one was reached—and guns change so much and so quickly by reason of rust, fouling, etc., in the course of their lives that even when the right one was reached it might not be possible to make an identification—it would take an average of 250,000 hours to make an identification, *i.e.*, one hour per comparison. Or let us suppose that 50 bullets per day came into the identification bureau from all makes of guns and all types of cases. Allowing the same time for examining each bullet, we have 12,500,000 hours per day devoted to comparisons of bullets.

But why continue to discuss absurdities? There is just one solution to the problem of the misuse of small arms in the United States. That solution, as we see it, is not by legislation; on the contrary, it is by encouraging the decent citizen by every means possible to arm himself. Absolutely no restriction should be put upon the sale or possession of arms and ammunition. The criminal is going to have them anyway, why not give the reputable citizen an even break? Indeed rewards should be offered to each householder who resists the armed hoodlum by gun fire. Every honest citizen should be urged and implored to become proficient in the use of hand firearms and to apply for a permit to carry them. This is the only way to beat the hoodlum at his own game. We venture to predict that with this condition prevailing crimes of violence would decrease 50 per cent in a year. Does Senator Copeland think the statement is extreme? We doubt that it is because we have in mind the situation in Switzerland where there is no restrictive legislation to curb the general and promiscuous use of firearms of any and all kinds. Indeed in Switzerland every adult, able-bodied man is required by law to possess and be proficient in the use of a military rifle. If in addition he has a revolver or two or a dozen if he wishes, so much the better. No license is required for carrying a concealed weapon on the person. Crime statistics, we believe, will bear out the assertion that in no country of Europe, save possibly England, are crimes of violence so few as they are in Switzerland. Unless something is done to prevent Senate Bill No. 2258 from becoming the law of the land it looks as though we are headed for the prohibition fiasco all over again and that it will take probably the same number of years of the same costly and bitter experiment to again convince the moralists that legislation cannot accomplish some things and that instead of improving an admittedly bad situation it generally makes that situation a thousand times worse. The law-abiding citizen will pay because the joke is on him.

Letter to the Editor

Thermite Incendiary Bombs

The Editor:

A recent article by Captain Liddell Hart in the *New York Times Magazine* (January 28, 1934) on "Air Armadas; A Growing Dread" disposes of the grossly inflated ideas of the possible destruction of cities and their populations by airplane attacks while at the same time emphasizing the importance of such attacks on war industry organization. Regarding the airplane gas attack he says: "As for an attack with gas bombs, this most popular bogey would seem to have still less substance when examined,"—upon which all of us who have studied the question heartily concur.

But the Captain failed to mention what is a far greater danger to cities than either gas or high explosive, namely, the thermite incendiary bomb.

Thermite, as we all know, is essentially an intimate mixture of aluminum powder and oxide of iron. When a small area of the mass is raised to a high temperature by a suitable primer, a violent reaction is set up which spreads rapidly throughout the mixture forming aluminum oxide and metallic iron. The temperature developed by the reaction reaches some 3000° Centigrade (5400° Fahrenheit) and the metallic iron flows out as an incandescent liquid since the temperature is some 1400° Centrigrade above its fusing point. The amount of molten iron produced is theoretically a little over one-half the weight of the thermite mixture.

Thermite, invented and named by Goldschmidt in the last years of the past century, has been a commercial product still used for welding rails, pieces of heavy machinery, such as steamship propeller shafts, rudder frames, etc., though largely displaced at present by the oxy-acetylene or arc-welding methods. It was used to a slight extent during the War in Stokes mortar projectiles mixed with enough high explosive to scatter the molten mass into a rain of droplets which would not only set fire to combustible matter but penetrate even steel helmets. Towards the end of the War, a thermite hand grenade was developed for the purpose of rendering useless enemy artillery, particularly the heavier pieces, —in case the point of an attack or raid should penetrate up to them and had little chance of holding the ground against the counter attack—by the simple process of dropping the ignited grenade into the muzzle of the gun. The molten iron welding itself to the rifling would put the piece *hors de combat* until relined. The only difficulty, of course, was that you first had to catch your artillery and the signing of the Armistice left that phase of the problem unsolved. Nevertheless, the ease with which even the heaviest piece can be put out of commission with a single thermite grenade makes the danger of sabotage by spies or traitors one to be seriously considered especially at the outbreak of a war.

Why this particular subject should be so generally ignored, is difficult to fathom. A Frenchman, well informed on military matters, stated to the writer some years ago: "We are not afraid of a gas attack on Paris by airplanes. If such an attack should come, there would unquestionably be casualties but no military result of any consequence would be achieved. By instructing the population, the number of casualties would undoubtedly be kept at a low figure. But, the thermite bomb would be far more dangerous. A hundred fires started in a short time at widely separate points might have appalling consequences."

And well they might. In the first place, the tactics of an incendiary bomb attack would be the opposite of a gas attack. In the latter the planes must fly close enough so that their bombs should drop as near together as possible both in time and location in order to build up an effective concentration on the ground. Consequently, they would offer an outstanding target to the defense, either air or antiaircraft. The tactics of the incendiary bomb attack would be just the opposite. The planes would fly widely separated so as to start fires simultaneously, or nearly so, at scattered points and the task of the defense would be multiplied many fold.

The incendiary bomb does not have to reach the massive proportions either of the high explosive or of the gas bomb to be effective. Many small fires may have far more serious results than one large one. Provided the bomb is of such weight as to insure penetration of a building roof, once inside the fire is sure to follow unless the building be of fireproof construction and the space under the roof free of combustible material.

No explosive is needed to scatter the thermite or even open the body of the bomb as would be necessary in the case of the gas bomb. The thermite would melt its way through and the heat developed would raise the casing to incandescence. It is easy to see what effect that glowing weight of metal, let alone the molten iron produced by the reaction, would have in the average attic. The molten iron would eat its way down through floor and ceiling igniting all combustible matter with which it might come in contact.

A fleet of some fifty bombers capable of carrying twenty 100-lb. bombs each and allowing only 10 per cent effective hits, could start almost simultaneously 100 very serious fires and give the best organized fire department a Herculean task to cope with. And wind, the enemy of the gas attack, would here be a most helpful ally.

While it is generally conceded that a gas attack on a large city would have no serious military consequences, a conflagration in a large center of population which necessarily is also either an industrial, commercial or administrative center, would achieve a military result. Just the feeding and sheltering of one or two million people who were taking care of themselves and are suddenly hung to the neck of the military organization in control in wartime is bound to cause more than a momentary ripple at headquarters.

Why the public should be so much preoccupied with remote danger and so little with a real one, is a question impossible to answer. Perhaps the human mind prefers to toy with fancies rather than face stern realties. Gas, of course, is comparatively new, mysterious and uncanny to the average mind and many legendary properties are attributed to it as the result of the World War and post-War propaganda, while fire has been familiar to the species since the days of Prometheus. In this particular case, however, familiarity should not be permitted to breed contempt. And it should be our duty to see that this most important danger is fully realized that we may not find ourselves unprepared in an emergency.

J. E. Zanetti,
Colonel, Chemical Warfare Reserve.

New York, N. Y.

Editor's Note: Attention is invited to the "Letters to the Editor" section of this Journal as a forum for the discussion of national defense subjects. Contributions are confined to constructive discussion and debate of topics best fitted to advance the interests of industrial preparedness. Letters usually should be limited to 500 words. Anonymous letters will not be considered. In elaboration of its policy to stimulate progress by qualified discussion of ordnance and its related problems, readers are invited to submit contributions to this section. The Editorial Board reserves the right to determine suitability for publication, in the performance of which function its decision shall be final. Army Ordnance can best achieve its purpose by free and constructive discussion of all matters which properly come within its field of activity.

Association Affairs

COLONEL JORDAN TO HEAD ARMY INDUSTRIAL COLLEGE

COL. HARRY B. JORDAN, one of the best known officers of the Ordnance Department, has been appointed director of the Army Industrial College effective with the beginning of the next school year. Word of his appointment to this important office was contained in War Department orders transferring him to duty in the Office of the Assistant Secretary of War about June 14, 1934.

COL. HARRY B. JORDAN.

Since April, 1931, Colonel Jordan has served as Ordnance Officer of the Third Corps Area where he has directed the ordnance activities including the repair and storage of arms and ammunition at all regular Army posts in addition to the artillery and small arms equipment and repair of the National Guard and R. O. T. C. A graduate of Washington College, Tacoma, Wash., and of the U. S. Military Academy, class of 1901, Colonel Jordan was for five years prior to his admission to West Point a member of Troop B, National Guard Cavalry of Washington. During his service in the Ordnance Department he commanded several of the arsenals. In June, 1918, he was appointed Assistant Chief Ordnance Officer of the A. E. F. and served as inspector of ordnance field establishments, Army ordnance inspector of artillery of the First Army, and was in charge of the artillery section of the Chief Ordnance Officer, A. E. F., until after the Armistice. Later he commanded the Rock Island Arsenal. He served on the War Department General Staff for three years, from 1928 to 1931, and is a graduate of the Command and General Staff School, the Army War College and the Army Industrial College of which he now becomes director.

THE 1918 GUN-HOWITZER PRODUCTION CLUB

THE death at Ardmore, Penna., on December 15, 1933, of Mr. A. A. Stevenson, chairman throughout its life of the Gun-Howitzer Production Club, makes it timely to examine the war record of the club. In January, 1918, an informal meeting was held in the office of Col. W. P. Barba of the Army Ordnance Department. Those present represented five firms commandeered by the Government for the manufacture of army ordnance forgings, and wholly inexperienced in that art. Discussion of their common problems showed that coöperation and exchange of ideas in the future would be valuable. At the next meeting a week later the foundations of the club were laid. Though no formal organization was proposed, Mr. Stevenson was asked to act as chairman, his gifts of tact and leadership being well known. Under his skillful and diplomatic guidance the group of novice gun manufacturers grew rapidly in importance.

By the end of the year it included in its membership the Army Ordnance Department, the Navy Bureau of Ordnance, and all the manufacturers of gun forgings in the country. At a meeting of the club shortly before the Armistice Maj. Gen. C. C. Williams, Chief of Ordnance, United States Army, said, "We have here today the most expert knowledge and skill that is in the United States in the matter of making gun forgings. . . . It is a very delightful thing to see all of the manufacturers gathered together here in harmony. It is probable that five years ago such a spirit of coöperation could not have been attained in any way."

When the United States entered the War in 1917 it was evident to the Army authorities that one of their greatest problems was to build up sources of supply for ordnance. At that time there were in existence in this country only two large companies competent to make gun forgings and only four competent to machine the guns; and all these companies had their capacities pledged to the absolute limit under long-time contracts with the Allies. It was necessary to build an ordnance industry of unexampled size and to build it new from the ground up. The scale of the undertaking may be judged from the fact that Great Britain a year after entering the war thought that they had done a stupendous thing in ordering 1,200 eighteen-pounder guns, while the initial American program called for 14,000 guns of three-inch caliber and larger. The Government selected groups of men and plots of ground and placed on these men the responsibility for the development of gun-forging plants.

As the development of plans took shape it became obvious that coöperation between the various manufacturers was desirable, so that the experience and thought of one might be at once available to all. Time was of the essence of the job. One of the earliest contacts between those proposing to make gun forgings occurred in December, 1917, when at Colonel Barba's suggestion, the President of one of the other companies called on Mr. Stevenson, Vice-President of Standard Steel Works Company, to discuss the manufacture of 9.5-inch gun forgings. Mr. Stevenson's reply to the suggestion that they talk things over, was characteristic of his humor and his singleness of purpose. It was to the effect that with the Sherman Law in force such discussion might land them in Atlanta, but as it seemed to be for the good of the country, he would take a chance. By the end of December coöperation between the manufacturers was made official. General Dickson wrote to General Jamieson saying that he thought it would be a good thing if the men manufacturing guns were to get together. This letter was turned over to Colonel Barba with General Jamieson's informal penciled endorsement, "Barba, please see to this." Colonel Barba's letter from the office of the Chief of Ordnance No. G.R.472.811/1351 of December 21, 1917, conveyed to various makers of gun forgings the suggestion that they should get together. A meeting took place in Colonel Barba's office in Washington on January 4, 1918. Five companies, all new to the manufacture of guns, were represented. Ordnance officers present were General Jamieson, Colonel Barba, Colonel Chisholm, and Colonel Hunt, who had all taken an active part during the preceding summer in allotting contracts and in scheduling methods and productions. These officers encouraged the continuance of such meetings.

Concurrent with the arrangements for this meeting in Washington the Company officials directly interested in the testing and inspection of gun forgings had been impressed with the desirability of coming together to discuss methods of testing and to arrange with the Army inspectors for uniform interpretation of specifications. A meeting had been arranged, but was postponed to take place a week after the preliminary conference in Washington.

The second meeting, in Philadelphia January 11, 1918, was very informal, no definite organization was planned, and no officers elected. Mr. Stevenson took the chair and the writer, then his assistant, undertook to act as secretary and keep minutes. From this beginning development was rapid. It was obviously

important for the rapid and successful production of gun forgings that the successes and difficulties of each manufacturer should be made available to all doing similar work so that all, being new to the manufacture of ordinance matériel, might develop the necessary technique with as little delay as possible. None of the companies represented had manufactured ordnance forgings, although experience in this art was available through Colonel Barba, Mr. Geo. Satterthwaite, Vice-President of the Tacony Ordnance Corp., and some other officials of the new companies who had had long experience with the old line ordnance manufacturers.

The position of the new manufacturers in regard to the old line firms was given much thought. Eventually it was concluded that the older ordnance companies could not properly be asked to coöperate in building up an industry which might eventually prove to be competitive with them. Independence also had the advantage that methods and practices could be developed freely along possibly new and better lines unhampered by existing traditions. Other new companies making similar ordnance forgings were invited to join, and a meeting was held in Chicago during February, 1918. At this meeting the group adopted the name "Greenhorns' Club" to indicate that the member companies were all in the novice class.

The advantage of interchange of information and ideas and the opportunity for united and uniform contact with the officers of the Ordnance Department became rapidly apparent, and meetings were held at the various plants at intervals of about six weeks. Mr. Stevenson continued as chairman and contributed a great deal to the success of the club. He had a real gift for understanding the human side of the technical coöperation and was indefatigable in seeing that the balance of consideration was held level for all interested.

The most valuable part of his work was not done as chairman during the official meetings, but in informal contacts with the individual members, stimulating interest in the coöperative work and smoothing out any possibility of discord before it passed beyond the incipient stage. His character and personality were such that he obtained the complete confidence of those with whom he dealt. At the same time he was an insistent fighter for right and principle. At the last meetings of the club when the Armistice was bringing its activities to a close, some of his Army friends and admirers described him affectionately at one of the meetings as "that white haired stubborn Scotchman . . . who has lost some of his stubbornness but none of his stick-to-it-iveness."

THE club grew rapidly in importance until at the meeting on August 6, 1918, at the Edgewater Steel Company's plant at Pittsburgh the conclusion was reached that the name "Greenhorns' Club" was no longer appropriate or desirable, and decision was made to change to a more dignified title. The questions of a name and details of the organization were left open till the next meeting, but Mr. Stevenson was elected permanent chairman and the present writer, permanent secretary. Colonel Barba pointed out that the club had grown until all manufacturers of large guns with the exception of Midvale and the Inland Ordnance Company were represented, and more and more Ordnance Department officials attended each meeting. It was at the same meeting that General Williams called attention to the fact that it comprised the most expert knowledge and skill in the United States in the matter of making gun forgings, all gathered together in harmony and coöperation.

The last business meeting before the Armistice was held September 9, 1918, in Chicago. A meeting in Bethlehem for October 21-22 was scheduled but postponed on account of the influenza epidemic. At the Chicago meeting the name of the club was changed to "The 1918 Gun-Howitzer Production Club." This retained the initials of the old name, indicated clearly the purpose of the club, and put on record the year of its foundation, a year which it was felt would be considered to be critical in the history of the United States. The objects of the club were shown by the following memorandum which was adopted:

Memorandum of the Objects of The 1918 Gun-Howitzer Club

1. The object of the Club is to further the production of gun forgings for the United States Government.
2. The Club will promote this object by the interchange of information regarding engineering details of manufacture, by the discussion of technical and practical problems connected with the manufacture of gun forgings, and by all other means in its power.
3. The Club shall be composed of companies actively engaged in the production of gun forgings for the United States Government, who shall be represented at the meetings of the Club by men actually engaged in and responsible for the production of gun forgings. No company shall have more than three representatives. It is understood that the production of ingots and blooms is part of the production of gun forgings.
4. The Club may elect to honorary membership such officers of the United States as may be designated by the Ordnance Department.
5. Other persons having a special interest in the purposes of the Club may be invited to attend any meeting subject to the approval of the Chief of the Production Division. Adopted at meeting of the Club, Chicago, September 9, 1918. The organizations represented at this meeting who had been members were: Watertown Arsenal, American Bridge Co., Bethlehem Steel Co., Buckeye Steel Castings Co., Edgewater Steel Co., Heppenstall Forge & Knife Co., Hess Steel Corporation, Illinois Steel Co., Standard Forgings Co., Standard Steel Works Co., Tacony Ordnance Corporation. Symington-Anderson Company, though a member from the first meeting, was not represented. Inland Ordnance Company, Tioga Steel and Iron Company, and the United States Steel Corporation (Ordnance Plant) were represented by invitation; and Midvale Steel Company, though invited, was not represented.

The following officers of the United States Army were invited to become honorary members of the Club:

Major General C. C. Williams, Chief of Ordnance, Brigadier General C. L'H. Ruggles, Colonel C. C. Jamieson, Lieutenant Colonel W. P. Barba, Lieutenant Colonel H. B. Hunt, Major K. O. Chisholm. The Navy Bureau of Ordnance had requested membership for the Bureau and for the companies making Navy gun forgings.

An important action taken at this meeting was a resolution authorizing the chairman to appoint four committees of three members each to report on the following subjects: Steel Manufacture, Forge Shop Practice, Machine Shop Practice, Heat Treatment and Tests. The committees charged with this work carried it to a conclusion after the Armistice. The reports which were distributed to the Army and Navy Ordnance Departments and to the member companies give complete detailed information regarding the manufacture of gun forgings as carried on by the companies concerned. For each company the reports gave definite information as to the complete procedure from the manufacture of the steel to the final testing and acceptance of the forgings. At the time, these reports were considered to be an invaluable record of the methods developed for the quantity production of high quality gun forgings.

The 1918 Gun-Howitzer Club held two meetings after the Armistice. One in Washington, December 14, 1918, and a final meeting at Philadelphia, June 6, 1919. At this meeting, it was unanimously decided that the Gun-Howitzer Club should continue as an association of individuals, not of companies, and that those who had represented companies or government departments at meetings should continue as members.

At the Washington meeting, General Williams wrote congratulating the club on the success which had attended its efforts and said that it was largely owing to the splendid work of the club that the Army had been so successful in the production of gun forgings. General Jamieson wrote that he felt that the members of the club were entitled to a special expression of appreciation from those officers associated with them during the period of the War who knew how whole-heartedly they entered into one of the most difficult production problems that faced the Ordnance Department. Admiral Ralph Earle said that he did not believe that any other country could do what the Gun-Howitzer Club had done in furthering quantity and quality production of guns. He believed that the continuance of the club would make it hardly conceivable that any other country would again feel like drawing a gun on the United States. He felt that the results obtained by the club should be recorded with information as to its origin, so that others might realize how much the manufacturers had really done in response to the requests of the Army and Navy.

The present account of the Gun-Howitzer, formerly the Greenhorns' Club, is the first record of its activities that has been made outside its own minutes or the archives of the Army and Navy Ordnance Departments. It has been compiled as a tribute to Mr. Stevenson, who as chairman was its guiding spirit throughout the brief but intensely active life of the club.

LAWFORD H. FRY,
Railway Engineer, Edgewater Steel Company, Pittsburgh, Penna.

As this issue of ARMY ORDNANCE goes to press word is received of the sudden death in a railroad accident on February 26 of Mr. Frank R. Dravo of Pittsburgh, Penna. These very pages of the last number contained an account of his participation in the functions of the Thirteenth Annual Meeting of the Association on December 14, 1933. In the following number we shall pay tribute to Mr. Dravo, sterling gentleman, great friend of national defense and charter member of the Association. At this time we desire to express publicly the feeling of personal sorrow which is shared by so many members of the Association, and to convey condolences to Mr. Ralph M. Dravo, brother of the deceased, President of the Pittsburgh Post, A. O. A., and to the entire Pittsburgh Ordnance contingent of which Frank Dravo was a staunch and zealous member.

THE following have been admitted to membership in the Army Ordnance Association since the last issue of ARMY ORDNANCE: Charles A. Albert, Charlestown, W. Va.; Melvin T. Anderson, Muncie, Ind.; John M. Archiable, Cincinnati, Ohio; Frank P. Babbitt, Whitefish Point, Mich.; Carl M. Beach, Cincinnati, Ohio; S. W. Bedell, Brooklyn, N. Y.; W. E. Best, Cleveland Heights, Ohio; Spencer B. Booz, Cincinnati, Ohio; Reuben E. Brown, Bend, Ore.; T. C. Carlsen, Cincinnati, Ohio; D. F. Carpenter, Bridgeport, Conn.; W. H. Casson, Euclid, Ohio; Edward J. Chapman, New York, N. Y.; Richard W. Coward, Birmingham, Ala.; F. L. Coykendall, Rochester, N. Y.; C. K. Davis, Bridgeport, Conn.; Woodrow W. DeMuth, Cincinnati, Ohio; Harold W. Gear, Cincinnati, Ohio; Robert E. Getter, Middletown, Ohio; E. E. Handy, Bridgeport, Conn.; C. J. Hueber, Cleveland Heights, Ohio; Cletus Juul-Nielsen, New York, N. Y.; Earl P. Kauffman, Cincinnati, Ohio; S. W. Little, Cincinnati, Ohio; Henry T. Luria, Reading, Pa.; L. F. Mitchell, Shaker Heights, Ohio; W. L. Moran, Newport, Ky.; Harry A. Paine, Cincinnati, Ohio; Howard C. Prine, Cincinnati, Ohio; J. J. Ring, Milwaukee, Wis.; M. W. Shayeson, Cincinnati, Ohio; William A. Stoddard, Cincinnati, Ohio; Ralph J. Thompson, Indianapolis, Ind.; Daniel S. Werner, Cincinnati, Ohio; R. H. Van Saun, California, Ohio; Robert Van Tuyle, Cincinnati, Ohio; William Warfield, Brooklyn, N. Y.; and John D. Wyatt, Fort Thomas, Ky.

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—for Students of Military History;
—for Advocates of Peace with Preparedness;
—for Just Plain American Citizens who believe in National Defense for the United States without militarism, without excessive burdens, without exaggerated nationalism, without unfriendly designs upon anybody anywhere.

Readers can assist in disseminating sane views and current information on Industrial Preparedness and related subjects by recommending their friends and associates for membership in the Army Ordnance Association. Fill in the attached blank and forward to the Executive Offices of the Association, 806 Mills Building, Pennsylvania Avenue at 17th Street, N. W., Washington, D. C.

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Book Reviews

GEORGE WASHINGTON HIMSELF. A Common-Sense Biography Written From His Manuscripts. By John C. Fitzpatrick. Indianapolis: Bobbs-Merrill Co. $3.50.

THERE have been a great many biographies of George Washington, most of which have included so many stories and myths that it has given a false impression of Washington, the man. Mr. Fitzpatrick by reason of his official position as editor of the United States Bicentennial Commission Edition of the Writings of George Washington, was in a position to paint a true picture of the man and to explode the myths which have been perpetuated by previous biographers.

The author assumes familiarity with the usual well known facts, and the book includes a great deal of new matter based on hitherto unpublished writings and letters of Washington and his contemporaries. So to appreciate this biography, the reader must have some knowledge concerning the life of Washington.

It is interesting to note that the greater portion of the book deals with Washington's early life and the periods of the French and Indian Wars and the Revolution. The reader will find that Washington, contrary perhaps to previous impressions, had a sense of humor. One of Washington's first trips as a young man was to the Shenandoah Valley with George William Fairfax. Washington was sixteen years old, and it was the first time he had been away from the civilization of his day.

The first stopping place was in a frontier cabin where, to quote George himself, "We got our Supper and was lighted into a Room and I not being so good a Woodsman as ye rest of my Company striped myself very orderly and went in to ye Bed as they called it when to my Surprise I found it to be nothing but a little Straw Matted together without Sheets or anything else but only one thread Bear blanket with double its Weight of Vermin such as Lice Fleas &c I was glad to get up (as soon as ye Light was carried from us) I put on my Clothes and Lay as my Companions." The next day they traveled up to Frederick (as Winchester was then called) "where our Baggage came to use, we cleaned ourselves (to get Rid of ye Game we had catched ye Night before) and took a Review of ye Town and thence returned to our Lodgings where we had a good Dinner prepar'd for us Wine and Rum Punch in plenty and a good Feather Bed with clean Sheets which was a very agreeable regale."

The author writes: "It can be stated with some confidence that there are more examples of honest humor in George Washington's letters than can be found in those of Jefferson, Madison, Hamilton, or any one of the Fathers except Benjamin Franklin. There is, too, a most satisfying extract extant from the letter of a Virginia lady who wrote from camp in 1777 to her friend, that when 'George Washington throws off the Hero and takes up the chatty agreeable Companion, he can be downright impudent sometimes, such impudence, Fanny, as you and I like."

The author pretty well disposes of such stories as how General Braddock ignored Washington's advice and that Washington saved the remnant of Braddock's forces through his leadership; that Washington had a love affair with Sally Fairfax, and that there was the least shadow between George and Martha Washington.

The dust cover states that a great mass of manuscripts have been ignored by Washington's biographers "under the comfort-

ing belief that the Sparks and Ford editions of Washington's writings contain all the important letters. They contain less than half the letters, and less than half the *important* letters. A George Washington has been thus created in the public mind utterly unlike the man he truly was."

It is somewhat difficult to follow the narrative because of the many references with which the reader is not likely to be familiar. Nevertheless no admirer of Washington can very well omit from his reading this especially authoritative work. Reading it will show most vividly that if there ever was a genuine patriot in the Revolution that man was George Washington.

GRUNDZÜGE DER WEHRPOLITIK. By K. L. von Oertzen. Hamburg, 36, Germany. Hanseatische Verlagsanstalt, A. G. 1933. 6 Reichmarks in paper, and 7 in linen binding.

THIS book, "Characteristics of Defense Politics," by Colonel von Oertzen, is an exposition of the why and wherefore of defense for the German Republic, a question to which the answer is not of interest to Germany alone, but also to all other nations, especially to those of Europe, since it plays a major rôle in both home and foreign politics. This requires that all interested politicians and statesmen become acquainted with the actual world situation in order to formulate a proper answer. This situation, with all its surrounding conditions, is presented by the author in a most interesting manner. Of course, Germany's special situation is the basic thought throughout the book. The abolishment of universal service in Germany has also abolished thought regarding this situation in many German minds, hence Oertzen endeavors to awaken a new spirit among the people.

Oertzen says that statesmen, militarists and industrialists often, but unknowingly, operate against each other, and he recognizes the most weighty reason for this condition in the decay of the real aspects of war and its cause. He therefore builds up his argument by first expounding the simple political reasons for armament; he then presents the realm of national defense, which he says cannot be destroyed by phlegmatic interest any more than can one bring about any romantic Utopia, which is not in conformity with world conditions, by selfish nationalism. He presents many examples for his argument without ever abandoning calm reason regarding possibilities and realities. He thoroughly examines troops, their organization, their dependence on the technical arts and on politics, and in particular to modern forms of combat, as well as the subject of disarmament.

The author does not offer any concrete proposals regarding the politics of national defense, but rather a serious thought which should be studied by all who wish to follow and understand the pros and cons of armament and disarmament. The book is a sober, lucid and constructive thesis which gives answers to all questions relating to this ever present world problem, of course tempered by the particular situation of Germany.

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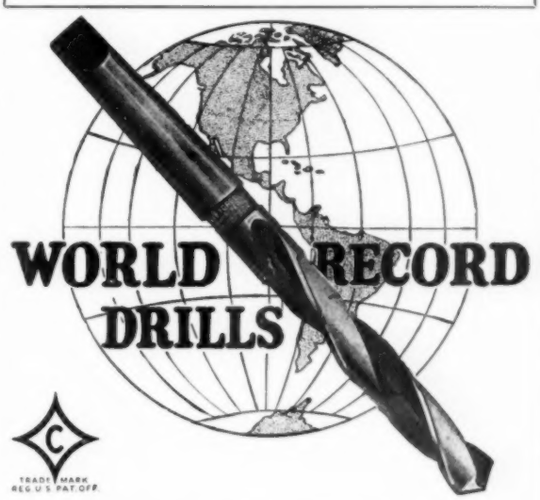

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